X PLANES

No: 14

William Wolf

WORLD WAR II US GUNSHIPS

YB-40 FLYING FORTRESS AND XB-41 LIBERATOR BOMBER ESCORTS

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CHAPTER ONE

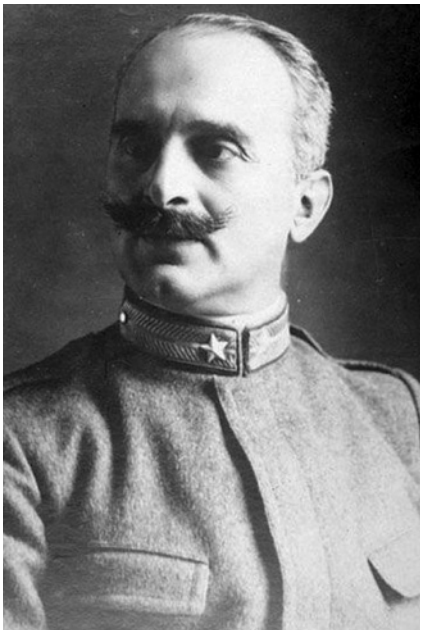
BOMBER ESCORTER CONCEPT

The XB-40 in what looks like a typical standard official photograph that was almost certainly taken at Wright Field in the winter of 1942–43, although this is not actually stated in the caption released with the image. (USAAF/Frederick A. Johnsen Collection)

In 1921 Italian Gen Giulio Douhet presented his concepts of the invincibility of large formations of unescorted bombers in his widely read volume *The Command of the Air*. Douhet's theories were ardently endorsed by the old-line US Army Air Service (USAAS) leadership, although they discarded his enthusiasm for mass area bombing at night, choosing to support precision daylight bombing instead. Additionally, the USAAS advocated the General's idea that bombers were the most important type of aircraft, and that pursuit fighters were not required, especially in the escort role.

Early USAAS theorist Gen William "Billy" Mitchell also believed bombers would be the primary factor for victory during wartime, but he speculated that pursuit aircraft could also play an important role in supporting the bombers which could be vulnerable to attack by enemy fighters. However, the entrenched senior officers of the US Army chose to court martial Mitchell instead and endorse the bomber's invincibility.

During the early stages of World War II, fighter aircraft from both the Luftwaffe and the RAF were unable to escort and protect bomber formations due to their inadequacies in range. When they were able to engage enemy fighters, they left their charges with no defense other than their own speed and armament, which, at the time, was limited by the bomber's design requirements and poorly performing engines. Ultimately,



Early air power theorist and advocate Gen Giulio Douhet, author of the widely read volume *The Command of the Air*. (Author's Collection)

Gen William "Billy" Mitchell, who had commanded all American air combat units in France by the end of World War I, was also an early champion of air power and the bomber in particular. (National Archives)

the unescorted bomber's inability to ward off enemy fighters led to both combatants limiting the scope of their daylight bombing and opting for less effective nocturnal raids instead.

FM 1-10, Tactics and Techniques of Air Attack, November 20, 1940 espoused the doctrine which affected the American strategic bombing campaign. While, it favored daylight bombing attacks, it also signified that escort support should be provided, when possible, wherever strong opposition was expected. Nonetheless, even after the failure of the early-war daylight bombing campaigns of the Luftwaffe and the RAF, the US Army Air Corps (USAAC) continued to believe in the invincibility of the bomber, maintaining its belief that B-17 Flying Fortress and B-24 Liberator bombers had enough firepower to complete unescorted missions without sustaining heavy losses.

Eventually equipped with modern, powered turrets that greatly increased the bomber's defensive capability, B-17F/Gs and later model B-24s were acknowledged as being the most heavily armed bombers of the period. Furthermore, the pre-war USAAC mantra that "the bomber will always get through" initially made it seem that there would be no need for a fighter escort, as heavy bombers in close formations would create a deadly crossfire of multiple 0.50-cal machine guns that would successfully fend off enemy interceptors.

Considered to be one of the war's premier heavy bombers when the B-17E commenced operations over Europe with the Eighth Air Force's VIII Bomber Command in August 1942, the aircraft's first encounters with Luftwaffe fighters graphically showed that it did not live up to the "flying fortress" moniker created by the US media pre-war and then actively cultivated by the USAAC.

Modifications were urgently required, but during World War II one of the continued conflicts faced by air arms on both sides was the question of which modifications were important enough to incorporate on, and slow, the production line? Generally, very few changes were deemed to be that vital, and this was the reason why so many air forces utilized field modifications to improve the combat performance of their frontline aircraft. The US Army Air Force (USAAF) utilized its unconventional system of modifications at forward field depots, with Col Paul "Pappy" Gunn's "up-gunning" of the A-20 Havocs and B-25 Mitchells of Gen George Kenney's Fifth Air Force in the South-West Pacific theater being a particularly successful example of this.

Field modifications undertaken by the Eighth Air Force's VIII Air Service Command were considered to be the best way of improving the survivability of the B-17 in that theater. Of several problems requiring rectification, the most important was the Flying Fortress's insufficient armament – particularly its limited, hand-held forward-firing weaponry. This weakness was fully exploited by Luftwaffe fighters when they mounted head-on attacks in 1942–43.

BIRTH OF THE "CONVOY PROTECTOR" BOMBER

By August 1942, the non-existence of long-range escort fighters and the proven inadequacy of the bomber's defensive armament led to a discussion within the top echelons of the USAAF about the conversion of B-17Fs and B-24Ds into bomber escort gunships. Designated the XB-40 and XB-41, respectively, these specialized bombers – called "convoy protectors" at the time – were to fly within conventional USAAF bomber formations and protect them. The convoy protector concept seemed to offer a possible solution to the problem, with the XB-40 being developed into the operational YB-40 (X stood for experimental and Y for service test).

The convoy protector could trace its lineage back to June 1941, when the USAAC's Experimental Engineering Section at Wright Field, Ohio, under the leadership of Chief of the Technical Staff, Lt Col H. Z. Bogert, began design studies to determine the possibility of converting bombers into escort aircraft. These studies were to establish the type of aircraft required, the location and caliber of its armament, crew arrangement, and armor plate protection. The Technical Staff requested a high priority to be assigned to the project, which it considered to be "one of the most difficult and important military aircraft problems" of that time.

Lt Col F. O. Carroll (seen here after he had been promoted to Major General) was Chief of the Experimental Engineering Section in the USAAC's Material Division when he issued a directive for the development of a convoy protector for medium and heavy bomber aircraft in September 1941. (USAAF)

The design study report concluded that the convoy protector must be multi-engined; have a speed in excess of and a range and ceiling equal to the bombers it was to protect; feature heavy armor to protect engines and crew; leak-proof fuel tanks and fuel and oil lines; be equipped with sufficient 0.50-cal multi-gun power turrets and flexible armament "to match gun fire with any two modern fighters making simultaneous attacks on it"; and carry the "maximum quantity" of ammunition. The studies also identified the anticipated armament requirement for a medium bomber convoy protector. The study report concluded that "if it were not expedient to design a new plane of this type, a study of the project could be made through the conversion of an existing type of bomber."

On September 17, 1941, Lt Col F. O. Carroll, Chief of the Experimental Engineering Section, submitted a request to Col Kenneth Wolfe, Chief of the Production Engineering Section, USAAF Materiel Division (which became Materiel Command on April 1, 1942), for the issuance of a directive for the development of a convoy protector for medium and heavy bomber aircraft.

The Experimental Engineering Division issued a Memorandum Report, also on September 17, 1941, that was much more comprehensive than the Experimental Engineering Section's design study. It began by describing the inadequacies of existing conventional Allied single-seat, fixed-gun fighter aircraft in "lending themselves

readily to convoy work," and continued by stating that the problems posed by combined attacks of multiple enemy single-seat fixed-gun interceptors "have not yet been solved in any manner at all satisfactory." The report acknowledged that "modern, heavily-gunned power turrets in bombers immensely increase their defensive powers, but the quantity and caliber of armament of modern fighters is also steadily increasing." Considering these assessments, the report concluded that "it was felt that the bombardment convoy protector was an effective solution to the problem of protecting [aircraft involved in] daylight bombardment."

The report presented an initial brief description of the convoy protector as a high-speed, multi-engined (probably four), pressure cabin aircraft, carrying a crew of six, having a high-speed slightly in excess of and having the same range as the bombardment aircraft it protected. The convoy protector's engines and personnel were to be protected "to a maximum amount" by armor plate, while its fuel and oil tanks, and their lines, were to be "heavily leak-proofed." There was to be a "sufficient" number of powerful multi-gunned turrets either locally or remotely controlled.

The report detailed features of the proposed convoy protector:

1. One dorsal mid-ships, 0.50-cal four-gun turret operating through 360-degree azimuth, and from three degrees below horizontal plane of rotation to 85 degrees above horizontal.
2. One ventral mid-ships 0.50-cal four-gun turret operating through 360-degree azimuth, and from three degrees below horizontal plane of rotation to 85 degrees below horizontal.
3. One tail turret with four 0.50-cal guns operating through a 180-degree cone of fire.
4. One aft-facing 37mm or 20mm cannon installed in each wing outboard of the furthest engine nacelle and operated remotely with the following angles of fire – 20 degrees up and down, and inboard sufficient for the cannon to intersect fire approximately 100 yards astern.
5. Ample computers, range-finders, and remote control devices to efficiently control all machine guns and cannon. The dorsal and ventral turrets were to be placed forward in the fuselage and as close as possible to the line of propeller rotation for adequate forward protection. The report believed that most of the protector aircraft's guns would be directed abeam and astern, above and below.
6. Twin-tails on the protector aircraft were favored because this configuration would allow all guns behind the nose to be brought astern in a very heavy concentration of fire.
7. The convoy protector aircraft, because of the nature of its mission, had to be able to absorb considerable enemy fire yet remain fully operational. Consequently, it had to be designed in such a way that its most important systems and equipment were well protected. It was therefore "essential" that extra armor was incorporated for both the crew and vital engine components, and that leak-proofed fuel and oil tanks, and their associated lines, were designed and installed.

8. The level of radio and navigation equipment to be installed had to be compatible with the requirements of its protector mission. The report also considered the protector aircraft as a possible "excellent destroyer for patrolling shipping lanes at sea on the lookout for hostile bombers". This would necessitate the fitting of more comprehensive navigation equipment and a long-range radio liaison set, although the latter had to be easily removable so that it could be carried as an alternate load.

The report specified that "conditions may be found to be such that it is not deemed expedient at this time to proceed with the above new design on a high priority status." It therefore suggested as an alternative "a certain number of some suitable existing type bombers to be stopgap convoy protectors. Such a conversion would undoubtedly not realize the speed, firepower, or range of the type set forth in the attached military characteristics, but it would be close enough to permit a study to be made of such a project.

"Such a converted bomber probably could not attain either the maximum speed or range of the convoyed bombers, but would be able to afford convoy protection over a large percentage of the mission which the bomber would be called upon to perform. The bombardment could be restricted entirely from those missions beyond the range of this particular type of protector, or its flights arranged in such a way that any portion thereof beyond the scope of the protector aircraft would be accomplished under cover of darkness."

The report stated that it was not its purpose to recommend what tactics would be employed by the convoy protector aircraft, as these tactics had never been previously employed. Nonetheless, the report speculated that they "probably" would consist of the following:

a. Cover the flanks of the formation, abeam, above, and below from enemy attacks "by flying between the bombardment aircraft formation and the most concentrated of such enemy attacks."
b. Protect the formation leader's aircraft. Both RAF and Luftwaffe fighter pilots prioritized shooting down this vital aircraft.
c. Protect the rear of the formation from straight-astern attacks, as well as from long-range attacks from directly to the rear.
d. Protect the formation from attacks by multi-place turreted fighters.
e. At the formation leader's direction, move from location to location within and adjacent to the formation as required.
f. The convoy protector aircraft were never to leave the formation, or its immediate vicinity, except in "unique circumstances when the formation was being exposed to an unusual type of enemy attack which could require it leaving."

The report indicated that one of the disadvantages of employing fighter escorts to protect bombers was that whenever the bomber formation was engaged by enemy interceptors, the protecting fighter had to turn to meet the attack in order to prevent it from reaching the bombers. In doing so, the protecting fighter would leave the bombers

unprotected to the attack of any other unengaged enemy fighters. The report noted that "because of its completely flexible armament, the convoy protector would never have to leave the formation it was protecting in order to efficiently combat, repel, and destroy enemy fighters."

The report used the Martin XB-33 as an example of a suitable aircraft for conversion into a convoy protector. This type will be discussed later in the book.

In conclusion, the report stated "that a new type of aircraft designated as a bombardment convoy protector is a requisite for successful daylight bombing operations." It recommended "the development of one or more experimental convoy protectors, using the military characteristics governing this type, be approved. Studies are to be made to explore the possibilities of converting some suitable bomber type into a practical convoy protector and, if these studies show the project to be worthwhile, that a conversion be authorized and made."

In conjunction with its September 17, 1941 Memorandum Report, the Experimental Engineering Division issued a Proposed Specification for the Military Characteristics of the Convoy Protector which included:

1. Range: For tactical operations it should have the equivalent radius of action and range of the bombers being protected.
2. Speed: The maximum speed was to be the highest obtainable in relation to its range and armament requirements. The altitude for maximum speed was to be consistent with the speed and altitude at which the bombardment aircraft operated. Speeds approaching 400mph were envisioned.
3. Flying characteristics: The take-off and landing characteristics were to match those of the escorted bombardment aircraft. Ease of take-off, control in flight, and landing were considered to be important, with maneuverability "slightly in excess of the bombardment aircraft."
4. Armament: The convoy protector armament was to consist of the maximum number of machine guns and auto-loading cannon turrets and gun emplacements, located so that "a maximum concentration of gun fire could be brought to bear on any point in a sphere of 100 yards radius surrounding the aircraft, with special emphasis placed on accurate and effective cannon fire through a rear cone of 45 degrees. The turrets, gun emplacements, and control stations were to be situated so that effective firepower may be concentrated upon all aircraft of a simultaneous attack by three conventional single-seat fixed-gun fighters or by multi-place turreted fighters, or a combination of the two."
5. Fire control: There was to be sufficient fire control apparatus to ensure efficient operation of the guns and cannon.
6. Bombs: No provisions for carrying bombs.
7. Photographic equipment: None, except for gunsight aiming cameras.
8. Crew: To be kept to an "absolute minimum" consistent with the tactical requirements of the mission.

9. Radio equipment: To be as light and compact as possible, and at a minimum consistent with the tactical requirements of the mission. Provisions for the quick installation and removal of long-range liaison radio for use in standard bombing missions or for when the convoy protector was to be operated as a standard bomber or for lone, long-range maritime patrols.
10. Instrument and navigation equipment: To be kept at a "minimum consistent with the requirements for effective daylight and night operations on military missions under all flying weather."

Once America was at war, the convoy protector aircraft moved from concept to reality. The Experimental Engineering Section Conference of April 1, 1942, presided over by Brig Gen Muir Fairchild, Director of Military Requests, revisited the current serious defensive armament deficiencies of both the B-17 and B-24 that the USAAF feared would make it impractical for the bombers to fly missions during daylight unless protected by escorts. In order to prevent projected losses to enemy aircraft, fighters had to be present from when the bombers attained cruising altitude and headed for the target to when they returned and made their landing approach back at base.

Brig Gen Muir Fairchild (seen here after he had been promoted to General in 1948) was Director of Military Requests in the spring of 1942 when serious defensive armament deficiencies in both the B-17 and B-24 needed to be urgently addressed prior to the aircraft being committed to combat in the ETO. (USAAF)

The conference dedicated substantial time to the "immediate problem" of developing a "suitable" escort for the B-24 and B-17. The general characteristics of the escort aircraft were again reconsidered, and it was agreed that it would be "essential" for the convoy protector to have ceiling, speed, and range performance at least equivalent to that of the escorted bombers. Since the convoy protector would have to fly for many hours and be subjected to repeated attacks, there was considerable concern about the comfort of its crew, their efficiency, and morale. The report pointed out that a long-range version of a pursuit aircraft "is not the ideal type for escort purposes because of the necessity for the pilot to remain in a relatively cramped position for long periods of many hours." This perception would change with the arrival of the Rolls-Royce Merlin-powered P-51 Mustang in the European Theater of Operations (ETO) from late 1943.

A report released following the conference stated that the convoy protector would remain as a "member of the bombardment formation and performs its mission by augmenting the defensive firepower of the bombardment formation." Since it was armed with more guns than the escorted bombers, the convoy escorter was to be provided with the maximum possible quantity of ammunition. It would be required to resist simultaneous attacks from several directions, "bringing to bear on any point in the sphere the fire of a stipulated number of 0.50-cal machine guns."

The report considered it to be "desirable" for USAAF Materiel Command to proceed immediately with the development of an aircraft suitable for escorting both the B-17 and B-24, but it also determined that the development of a completely new protector would "probably be unduly time-consuming." The Vega Airplane Company (a subsidiary of the Lockheed Airplane Company) of Burbank, California, submitted a sketch of its proposed modification of the B-17E model, which served as a "useful bit of talking paper", although it was specified that it did not represent either Vega's or Materiel Command's "final view on the subject." The consensus of the conferees was to make the necessary modifications on existing Liberators and Flying Fortresses "to render them suitable for escort use."

During the conference there were repeated referrals to the "serious deficiencies" of the forward defensive armament of both the B-17 and B-24. Brig Gen Fairchild considered the correction of this problem to be "one of the most important projects confronting the Materiel Command today." Axis fighter pilots had taken advantage of this armament deficiency by executing head on frontal attacks against early-model Liberators and Flying Fortresses.

A simultaneous frontal attack was favored, made by two enemy fighters, not directly head on, but one from the right front quarter and the other from the left front quarter. This attack would shield the enemy fighters by remaining in the "dead space" created by the bomber's inboard propeller discs. While in this dead space the enemy fighters would be exposed to the fire of only a single, rather impotent, 0.30-cal flexible gun in a hand-held ball mount. Because one attacker would be slightly ahead of the other, there was not enough time for the gunner to remove the weapon from the ball mount on one side of the nose and insert it in the ball mount on the other side, thus leaving the bomber virtually defenseless.

The fitting of two fixed 0.50-cal machine guns or a 20mm cannon in the nose of the B-17 and B-24 was considered, although Brig Gen Fairchild eventually decided that the installation of such weapons was "merely an improvisation" that should only be employed if it was unfeasible in the time available to install a satisfactory flexible gun mounting. The report recommended that a "minimum" of two 0.50-cal machine guns of some type be installed into the nose position as a high priority, for many more USAAF bombers were soon to see combat overseas.

Immediately after the conference had concluded, the Wright Field Armament Laboratory was directed to initiate a redesign of the noses of the B-17 and B-24 as soon as possible, even though such work would compromise the bombardier's position. In response, the Armament Laboratory improvised the installation of two flexible 0.50-cal machine guns in the respective noses of both bombers. Simultaneously, it instigated a project to incorporate some form of power-operated dual 0.50-cal machine gun installation in the noses of the aircraft. The Armament Laboratory also obtained the first Bendix chin turret to be completed for installation in a B-17F at Wright Field, after which the bomber was sent to the USAAF Proving Ground Command

(AAFPGC) at Eglin Field, Florida, for the firing tests requested by Brig Gen Fairchild.

The status of the improved Bendix four-gun ventral turret was also discussed at this time, and Brig Gen Fairchild requested "that everything possible be done to expedite the installation of one of these turrets in an airplane for the purpose of obtaining flight tests at Eglin Field." Fairchild stated that if the improved turret was not satisfactory, he would recommend to Brig Gen Oliver P. Echols, Chief of Materiel Command, that its production be stopped immediately.

Brig Gen Oliver P. Echols (seen here after he had been promoted to Major General) led the USAAC/USAAF's Materiel Division/Command for much of World War II. (USAAF)

REQUIREMENTS OF THE BOMBARDMENT ESCORTER

On April 9, 1942, in a report to Brig Gen Echols, Col Marvin Gross, Executive Director of the Military Requirements Division, recognized as definitive the proposed military requirements for what was now being referred to as a "bombardment escorter aircraft," and directed that "immediate action" was to be taken to meet the requirements as previously outlined.

The tactical mission of the bombardment escorter aircraft was "to accompany and defend bombardment types of airplanes and other airplanes having insufficient inherent firepower for their own protection when engaged in daylight missions subject to hostile action." Its minimum acceptable requirement was defined as to be equal to the aircraft being escorted in terms of maximum and operating speeds, ceiling, range (plus five per cent additional mileage), and take-off characteristics. Its armament was to be a minimum of two 0.50-cal machine guns covering all points of the sphere of fire, and to be able to cover simultaneous attacks from three directions with a minimum of two guns in each direction. No bombs were to be carried. The crew was to be made up of a pilot, co-pilot, fire control officer, navigator-gunner, radio operator-gunner, and any other gunners required to operate all the existing defensive armament. Radio equipment, instruments, and navigation equipment were to be at a "minimum consistent with the effective operation of the airplane on military missions under all-weather flying conditions."

The bombardment escorter aircraft's structure and design features were described as follows:

a. Armor plate passive defense was deemed as "very important" for all crew members.
b. Each turret was to be limited to not more than two 0.50-cal machine guns.
c. Design features were to be incorporated that increased effective firepower in all directions without reducing speed, range, and ceiling.

The Bendix chin turret advocated by the YB-40 program went on to fame with the B-17G as a frontal defensive armament. Abundant supplies of chin turret aluminum tubs evidently were made during the camouflage era, with a number of bare metal B-17Gs using gray-painted chin turrets as seen here. (Frederick A. Johnsen Collection)

d. The maximum amount of ammunition was to be carried at each gun station consistent with load distribution and the aircraft's performance.
e. Ammunition stowage was to be designed so that the maximum number of rounds could be fired without reloading.
f. The reconversion of the escorter aircraft back into a bombardment type was considered to be "highly desirable."

The possible future replacement of the 0.50-cal armament with cannon was to be considered if enemy fighters received more powerful armament and advanced gunsights. This change was proposed for the future B-29, B-32, and B-36 bombers, but was held in abeyance for the B-17 and B-24 pending the "experience with the bombardment escorter type airplane."

These requirements were to be "effective in the development of a suitable bombardment escorter airplane, and can probably be obtained most quickly through the alteration and modification of the type of aircraft being escorted." Col Gross concluded by stating that it was "desired that action be taken at once to meet the stated requirements."

On April 13, 1942, CTI-571 directed the development of a "bombardment escort plane having the performance characteristics at least equal to those of the B-17 and B-24, and to be equipped with a minimum of two 0.50-cal machine guns covering all points of the sphere of fire." Logically, conversions of the B-17 and B-24 were proposed for the role. The Lockheed XP-58 heavy, twin-engined fighter, then still in development, was considered "suitable" for escorting medium and light bombers.

CHAPTER TWO

XB-40/YB-40 BOMBER ESCORTER

The B-17F was basically an E-model with a number of modest improvements. In fact, the first 300 examples had been ordered from Boeing as B-17Es and subsequently re-designated as F-models. Upon reaching the frontline, modifications to the B-17F's armament were dictated by combat reports and were mostly made in the field by the Eighth Air Force's VIII Air Service Command.

By May 1943, 59 modifications had been incorporated into the B-17F, with 19 relating to armament. Most of these were made so that the aircraft could better defend itself against frontal attacks by Luftwaffe fighters. The ineffective single 0.30-cal (500 rounds per gun) machine gun in the nose was slowly replaced by a 0.50-cal Browning M2 machine gun on a steel tube mounting that was tested in various locations in the nose cone. A 0.50-cal machine gun was installed on either side of the nose, firing through cutouts in the new single piece of Plexiglas and supported by steel tube mounts to absorb the recoil that the previous Plexiglas sockets were unable to do.

The B-17's narrow nose compartment meant that the two new guns had to be staggered, with the 0.50-cal in the right side window cutout being located a few feet forward of the left side cutout. Some 0.30-cal ball and socket mounts were modified and reinforced in the field by VIII Air Service Command to accommodate a 0.50-cal gun. This was placed off center in the right-hand side Plexiglas nose so as

The sole XB-40 prototype, 41-24341 was the second production B-17F-1 Boeing-built Flying Fortress. It first flew on May 30, 1942 before being delivered to the Cheyenne Modification Center, where its conversion into a bomber escort was delayed by problems with the supply of turrets. After serving as the XB-40 test bed, it was sent to the 3704th BU at Keesler Field, Biloxi, Mississippi, on November 22, 1943 and ended its service as an aluminum ingot on April 4, 1945. (Frederick A. Johnsen Collection)

A close-up of the inadequate nose armament fitted in the iconic B-17F-10 41-24485 *"MEMPHIS BELLE,"* which left the aircraft vulnerable to Luftwaffe frontal attacks. To augment the single 0.30-cal protruding through the Plexiglas nose, cheek guns were installed in later F-models as they rolled down the production lines. When these were also found to lack the defensive "punch" required in the ETO to deter head-on attacks, the USAAF instigated the development of the chin turret. (USAAF)

to accommodate the bombsight. When not in use, the gun was held out of the bombardier's way by bungee cords.

Often, another 0.30-cal was mounted in the nose, thus increasing the F-model's forward armament to two 0.50-cals and two 0.30-cals. Originally, the two 0.50-cals could only be fired straight ahead, but eventually the windows and mounts were modified to increase the forward traverse. These larger weapons interfered with the operation of the bombsight to such an extent that the latter was usually removed and the bombardier had to toggle-drop his ordnance with the lead bomber.

Later F-model production batches (B-17F-70 to 130-BO, B-17F-35 to 65-DL, and B-17F-35 to 50-VE) had a single 0.50-cal machine gun installed in a purpose-built cheek mount located on either side of the nose.

VIII Air Service Command also developed a modification that allowed twin tubular-mounted 0.50-cal guns to be attached to a braced structure within the nose section, with the barrels protruding through a large aperture in the Plexiglas. A fireproof fabric around the barrels prevented air from blasting in the gunner/bombardier's face as he crouched behind the guns. No armor protection could be provided for the crewman, although metal plating was attached to the supporting frame under the guns. The bombardier was unable to operate the bombsight with this installation in place, so he functioned purely as a gunner and bomb-toggler. The recoil of this installation was so severe that it caused poor accuracy, and the field-of-fire was reduced to a 15-degree cone. In combat, B-17s mounting these guns were to fly in a position flanking the group leader so as to give the latter supporting protective fire.

After an unknown number of these twin units were fitted, VIII Bomber Command standardized on a single 0.50-cal installation devised by the 306th Bombardment Group (BG) in April 1943. The mount was centrally located in the top of the nose, which gave the gunner a much broader cone of fire. To use the bombsight the bombardier had to secure the gun with a bungee. The initial mounts were built by VIII Air Service Command and distributed to air depots as kits. The Eighth Air Force requested that this mount be standardized on B-17Fs leaving the production line, but it was not until May 1943 that the first brand new F-model arrived in Britain with this armament in place.

The other weaponry specified for the F-model was as follows: Briggs Sperry A-1 dorsal turret with twin 0.50-cals (500 rounds per gun); two 0.50-cals in waist positions (400 rounds per gun); Briggs Sperry ventral ball turret with twin 0.50-cals (500 rounds per gun); single

0.50-cal in the radio compartment (500 rounds); and two 0.50-cals mounted in the tail position (500 rounds gun).

The problems associated with the introduction of the Briggs Sperry ball turret after the 113th B-17E were mostly remedied by the time the B-17F entered service. The ball turret was fitted with an interrupter cam unit to prevent shooting off parts of the bomber. The first such units were designed so that if one gun was about to fire at any part of the aircraft, both 0.50-cals were stopped. This was undesirable in combat and modifications were made so that guns were interrupted individually. Even with this modification, the guns of turrets turning at high-speed continued to hit the bomber because there was a time lag between the last bullet being fired and the interrupter mechanism stopping the weapon. Briggs Sperry solved this problem by taking into account this "slew rate."

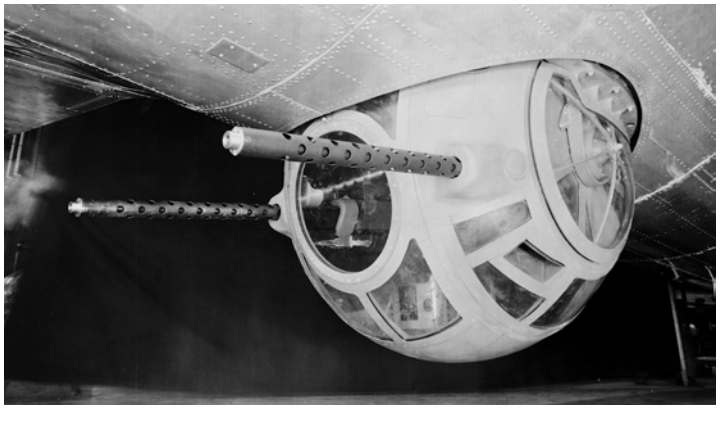
This Douglas-built B-17F represents the type of bomber intended for protection by the YB-40 escort. It was one of the 3,305 standard F-models manufactured by Boeing (2,300), Douglas (605), and Vega (500). Essentially, the B-17F was an E-model, with the initial 300 being ordered from Boeing as B-17Es and later re-designated as Fs. The B-17F's armament was soon seen as being inadequate, with combat reports principally from the conflict in Europe influencing modifications to the F-model's armament. Most of the changes were made in the field by the Eighth Air Force. (Peter M. Bowers/ Frederick A. Johnsen Collection)

When in certain positions, the metal framework of the turret dome obscured the gunsight, and this frame structure was removed at the depots. The ball turret was subsequently redesigned and the changes incorporated during manufacture at Briggs Sperry.

The waist gunners were usually the cause of self-inflicted damage to the wings and empennage. Gunners from the 303rd BG's 359th Bombardment Squadron (BS) developed an electrical cut-off device that automatically stopped the firing mechanism. It was duly authorized for manufacture at depots and fitment to all waist guns.

B-17F CONVERSION

Materiel Command informed Vega that the conversion of an existing aircraft (namely the B-17F) to perform this "new mission" of bombardment escort was the first planned approach, and that



The 44-inch diameter spherical turret that encapsulated the gunner and guns was informally called "the Ball." Although commonly referred to as the Sperry ball turret, after its designing company, it was also manufactured by Briggs and Emerson. The B-17F standard A-2 non-retractable ball turret replaced the XB-40's semi-retractable Briggs Sperry turret. The lower ball turret, first introduced during production of the B-17E as depicted here, was retained on the F-model and its offshoot XB- and YB-40s. B-17G production continued to use evolved variants of the design. (Boeing/Frederick A. Johnsen Collection)

The Vega Airplane Company, a subsidiary of Lockheed, was contracted to design and modify a B-17F into the XB-40 (X for "experimental"). During 1941, Vega entered a production pool with Boeing and Douglas – abbreviated as BVD – to produce the much in demand B-17F. Of the more than 12,000 B-17s produced, 2,750 would be built by Vega. B-17F 42-5705 was the first Vega-built Flying Fortress to roll off the Burbank production line, in June 1942. It is seen here surrounded by a crowd of employees admiring their handiwork. (Lockheed Martin Skunk Works/Frederick A. Johnsen Collection)

"certain compromises must be made in any such program." As it was "necessary to prove as quickly as possible the utility of the proposed type, it appears to be the only practical solution." Materiel Command enumerated the qualities of the B-17F, resulting in it being chosen for conversion:

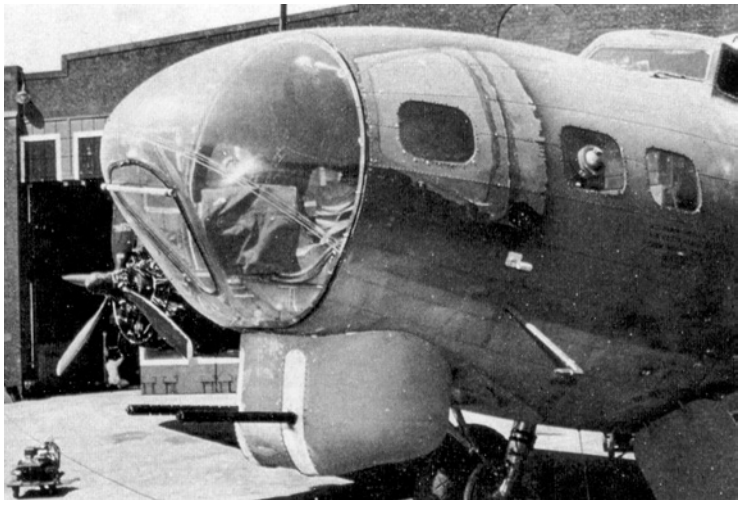
"It is a proven design, has adequate performance, is known to behave well under gunfire, and can be loaded to conditions considerably above its normal weight. As an immediate answer, therefore, the B-17F airplane, modified by increasing the fire coverage, ammunition load, and armor protection, appears promising."

The normal gross weight of the aircraft was to be kept at not more than 58,000lbs, consistent with the distribution of the ammunition load, armament, and armor plate as previously discussed with Vega representatives. An alternative load condition was to be considered in which sufficient fuel was added to permit escorting a standard B-17F bomber loaded to its maximum range potential.

Materiel Command concluded by inviting Vega to submit a proposal for the design and modification of a B-17 into a bomber escort, stipulating that the airframe to be worked on was to be removed at a convenient time to the manufacturer from its Burbank, California, production line. Quotations on cost, estimated delivery, and effect, if any, on Vega's current contract for the delivery of B-17Fs were to accompany the design study. Materiel Command admonished, "It is contemplated that the design will be held as simple as possible, and

will utilize only those items of equipment and furnishings which are now available or which will become available in the near future."

Col A. E. Jones, Chief, USAAF Contract Section, asked Vega to submit a proposal entailing the design and modification of a B-17F into an escort aircraft, along with quotations on the cost, estimated delivery, and the effect on other Vega contracts. During mid-May 1942, Vega submitted a provisional proposal to convert a B-17F into an XB-40 escort/gunship as the Vega V-139 for $101,659, plus a fixed fee of $6,099. These figures were subsequently increased to $161,320 and $8,839, respectively.



This B-17F was the first Flying Fortress to be fitted with a chin turret (albeit in mock-up form) in preparation for the real thing being installed in the XB-40. (USAAF)

On June 13, 1942, Boeing eventually replied to Materiel Command's request for a "quick conversion" of the B-17F into a bomber escort. It stated that although the company understood the USAAF's haste in acquiring such an aircraft, Boeing would rather focus on an all-new bomber escort. To this end it stated:

"The conversion is not intended to be the final answer but is expected to furnish information upon which to base further action. No immediate action, therefore, is contemplated on the design of an entirely new type of airplane until the conversion has been adequately studied."

Boeing's reply then went on to suggest a future new escort aircraft:

"As already stated, the design of an entirely new type of airplane is not being considered at this time. The military characteristics previously supplied to you were drawn up with an eye toward the conversion of an existing bombardment airplane. It is quite possible, as a result of the studies being made, that the future escort directives will not require provision for conversion of a bombardment airplane."

Less than three weeks later, on July 2, Lt Col F. O. Carroll of the USAAF's Experimental Engineering Section informed Vega that the second production B-17F-1 (41-24341) was being modified at the Cheyenne Wyoming Modification Center to permit the installation of a Bendix chin turret. The Bendix Products Division of South Bend, Indiana, anticipated that work could be completed by July 6 or 7. A power-operated tail gun turret manufactured by the United Shoe Machinery Company (USMC), of Boston, Massachusetts, was already available for installation on June 24. As soon as these turrets were installed by Vega, the B-17F was to be flown to Eglin Field for flight testing.

After a week's delay in the anticipated delivery of the chin turret, personnel from Materiel Command met with Bendix representatives on July 15 to ascertain what was causing the hold up. They were told

long-running gunsighting issues had just been resolved through the employment of flexible shafting to drive the sight in both azimuth and elevation. Also, Bendix had recently decided that the bombardier/gunner's seat had to be mounted on tracks running fore and aft so as to provide the crewman with greater comfort and to enable him to assume the gun's firing position in minimum possible time.

The completion date for the chin turret only was put back to July 27, while delivery of the gunsight was now scheduled for August 20. Because of this schedule, it was suggested that Bendix ship only the turret to the Cheyenne Modification Center on the 27th. This would allow the finished turret (less sight) to be installed, instead of using the mock-up turret (without amplidyne drive or gunsight) that was already available on July 7. Fitting the genuine turret would also reduce the installation time of the sight once it became available.

Materiel Command would wait no longer, however. To expedite all-important Eglin Field testing, the chin turret mock-up was immediately installed at Cheyenne, while senior officers from Materiel Command emphasized to Bendix the importance of it expediting the completion of the chin turret so that it could be delivered to Vega for the B-17F bomber escort conversion. The Cheyenne Wyoming Modification Center estimated it would take approximately ten days for the turret to be installed.

On August 5, after the delays caused by Boeing's late response to the USAAF's bomber escort request and Bendix's turret problems, Vega resubmitted its May proposal to Col A. E. Jones for the conversion of a B-17F that had been partially completed by Boeing. The adjusted proposal was conditional on the aircraft (41-24341) being substantially to Boeing's original specifications for a standard B-17F bomber and declared by Materiel Command to be "in all respects satisfactory." Vega would assume no responsibility for materials, workmanship, or performance other than for work it had performed using parts it had supplied.

Once the aircraft had been received by Vega, on or before August 15, the company anticipated that the elapsed time necessary to complete the conversion would be 130 days. At this time Vega was aware of the delay in the delivery of the aircraft with the chin turret mock-up installed and other Government Furnished Equipment (GFE) specific to the bomber escort. It stipulated that due to these delays, the company would "use its best efforts to ensure completion of the work within such time . . . consistent with such delays." Upon the installation of the complete Bendix chin turret, the aircraft was to undergo ten days of testing.

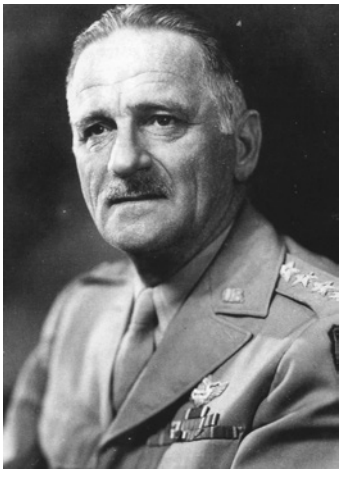
B-17F 41-24340 – the very first F-model built, which was retained by Boeing for testing – is seen here fitted with a nonstandard chin turret and the ADF antenna housing still in the forward location as used on the B-17F. The XB/YB-40 and subsequent B-17Gs with chin turrets moved the ADF antenna further back on the fuselage. (Boeing/Peter M. Bowers Collection via Frederick A. Johnsen)

The XB-40's first flight took place on November 10, 1942, and it was subsequently sent to the AAFPGC at Eglin Field nine days later for testing. The aircraft was eventually delivered to Materiel Command HQ at Wright Field as the XB-40 armament test bed, with a dorsal turret and pair of twin 0.50-cals in the radio compartment faux turret, giving 41-24341 a total of 14 guns. (Frederick A. Johnsen Collection)

Vega's updated estimated total cost was $102,883, plus a six per cent fixed fee ($6,173), for a total of $109,056 under contract W535 ac-28120. If the company was required to perform additional work or supply extra parts not included in the original contract, these would be subject to further negotiations. Vega also agreed to fabricate and supply a duplicate set of parts that were to be used in the manufacture of the bomber escort. Because Boeing and Cheyenne had already started the conversion, Vega requested that the contract be issued as soon as possible. However, the company's August 5 contract submission would not be approved until October 9, with Vega being paid $101,639, plus a fixed fee of $6,099 ($107,738 in total).

On August 8 41-24341 was delivered to Vega from Cheyenne – a week earlier than had been expected. The aircraft was fitted with a USMC power-operated tail turret and a mock-up Bendix chin turret. A Briggs Sperry semi-retractable ball turret had been delivered to Vega on August 3, followed by a Martin dorsal turret three days later. The installation of the latter into the radio compartment began on August 7, with the Briggs Sperry ball turret following on the 10th. The USMC power-boosted twin waist guns for either side of the central fuselage were to be ready for shipment to Vega by August 19, with the Bendix chin turret following 24 hours later. With this conversion work now well on the way to completion, Vega's August 5 bid proposal was accepted by Col A. E. Jones substantially as written.

Brig Gen Carl Spaatz (seen here later in the war as a General) was initially an ardent supporter of the bomber escorter while serving as Commanding General of the Eighth Air Force in 1942. (USAAF)



On August 21 Maj Gen Carl Spaatz, Commanding General of the Eighth Air Force, stated that what he termed "the destroyer escort plane project" had his "complete approval." He pointed out, however, "that to be effective the project had to be completed by February 21, 1943," and that it should not interfere with normal B-17 and B-24 deliveries – except for the first six aircraft of each type, which were to proceed along regular production lines. He specified that "these ships should be designed so as later they could go through the regular production line, because if successful, they would be needed in considerable numbers."

Three days later, a detailed progress report on the Vega XB-40 conversion concluded that "Installation of all units of the . . . conversion is progressing in a very gratifying manner" and that the progress is "satisfactory, all problems are being met squarely, and solutions are being applied without delay." With the many installations to be completed, there were many problems and fixes that included:

1. The USMC tail guns, while mostly received as complete, had their armor plate and bullet-proof glass represented as wooden and Plexiglas mock-ups.
2. The chin turret supports were of "marginal" quality and required replacement or strengthening.
3. The fairing installed aft of the chin turret interfered with the loop and IFF antennae, which had to be moved further aft. The pitot static tubes were relocated on the sides of the nose section.
4. The skin over the radio compartment was removed to mount the Martin dorsal turret and the surface control cables were re-routed around the turret.
5. A supporting structure was installed for the ventral ball turret.
6. The side gun mock-up installation was mounted on one side of the fuselage, along with a mock-up of its armor plate.
7. To expedite the procurement of armor plate, the supplier was requested to obtain it from bulk stock available on the West Coast.
8. The location of spare ammunition boxes in the radio compartment made it necessary for them to be sufficiently small so as to be easily carried through the aircraft (150 rounds per box) during flight. Wooden mock-ups of these boxes were fabricated, with two boxes also placed at each gun position.

Vega was to conduct flight testing to prove the airworthiness of the XB-40 and to determine if the chin turret guns operated satisfactorily. The aircraft was then to be prepared, with all removable equipment aboard, to fly to the AAFPGC at Eglin Field.

On August 29, Vega informed the Experimental Engineering Section that the XB-40 would be ready for chin turret testing on September 5. Due to the project's "urgency", and the availability of Bendix service engineers at Eglin Field, the XB-40 was to be flown directly to Florida for the tests.

On August 31, Brig Gen A. J. Lyon, USAAF Headquarters, ETO, submitted Technical Report 239 which specified the "must have" general and detailed requirements for a destroyer aircraft. The general operational requirements were:

1. Need to intermingle themselves with bomber formations;
2. Render the same appearance as the bombers being escorted;
3. Insert themselves between the bomber formation and the attacking enemy aircraft, and "by the use of heavy firepower and heavy armored protection successfully repel the enemy aircraft."

The range requirement was to be 1,700 miles at normal cruising, based on operations against targets 600 miles from take-off. The armor plate requirements were that crewmembers, engines, and "critical accessory equipment" was to be protected by armor plate. The XB-40's minimum requirements in terms of ammunition were specified in minutes of continuous fire.

XB-40 AS AN ATTACK BOMBER

By early September 1942, uncertainties had arisen among USAAF factions as to the role and armament of the bomber escorter. It was suggested that a nose-mounted 75mm cannon, with a 20-round feeder,

and two 0.50-cal machine guns be considered. Although this was an unsuitable armament array for a bomber escorter, it led the USAAF to consider the latter as a low-altitude attack aircraft. However, the Douglas A-26 Invader and the Beechcraft XA-38 Grizzly were under development for this role.

On September 9, Col Kenneth Wolfe, Chief of Production Engineering Section, USAAF Materiel Command, and 1Lt Lien flew the XB-40 from Vega's Burbank plant to the AAFPGC at Eglin Field, where testing would commence within 24 hours. Sixteen days later, the AAFPGC issued a Preliminary Memo Report on the results of the 10–17 September tests of the Bendix chin turret and the USMC tail gun installation. It also compared the chin turret installations in both the XB-40/B-17F and the XB-41/B-24D.

At the time of testing, the escorter aircraft was scheduled to be equipped with the following armament – Bendix chin turret, Briggs Sperry ventral ball turret, USMC tail turret, Martin dorsal rear (radio compartment) turret (without profile interrupter), and the standard B-17F dorsal forward turret. The chin turret was given the first priority in these tests, with trials of the other armament being carried out concurrently so as not to delay the XB-40's return to Vega.

BOEING XB-40 41-24341, WRIGHT FIELD, OHIO, JANUARY 1943

XB-40 AMMUNITION DISTRIBUTION		
Location (guns)	**Rounds Per Gun**	**Total**
Bendix chin turret (two guns)	400	800
reserve (in two 200-round boxes)	400	800
Briggs Sperry forward dorsal turret (two guns)	400	800
Martin rear dorsal turret (two guns)	600	1,200
USMC waist guns (four guns)	300	1,200
USMC tail guns (two guns)	550	2,200
reserve (in two 150-round boxes)	300	600
reserve (in ammunition tracks)	250	500
Briggs Sperry ball turret (two guns)	600	1,200
Reserve for all stations: four 200-round boxes	800	
and 20 150-round boxes	3,000	
Total rounds carried		**13,900**

Notes:
Specifications for gun ammunition requirements were also stated in minutes of continuous fire as follows:
Rear guns – four minutes of continuous fire.
Ventral and dorsal guns – two minutes of continuous fire.
Side guns – one minute of continuous fire.
Forward guns – one half-minute of continuous fire.

Ammunition aft of Station No. 6 was moved into the radio compartment before take-off and landing. The radio compartment served as additional storage for a maximum of 6,000 rounds to supply all gun positions except the Martin dorsal rear turret, the reserve for which was placed in standard Martin ammunition boxes. The reserve ammunition was stored in special 150-round containers identical to those used at the waist and tail gun positions. This lighter box size was chosen as it facilitated the movement of the reserve ammunition aft by the gunners or ammunition stocker in flight.

XB-40 ARMOR PLATE PROTECTION
Nose gunner's front shield – 142lbs of steel
Nose gunner's No. 3 bulkhead – 118lbs of steel
Pilot and co-pilot – 133lbs of steel
Sperry dorsal turret No. 4 bulkhead – 145 lbs of steel (also furnished some protection for pilots)
Martin dorsal turret – 144 lbs of steel
Briggs Sperry ball turret – 25lbs of steel
Side gunners – 167 lbs of steel, including transverse steel shields aft of each gun position and a duraluminum deflector plate along fuselage skin at gun positions
Servo motors – 20lbs of steel
Tail gunner – 273lbs of steel and duraluminum deflector plate
Total fuselage armor plate – 1,467lbs of steel
Total powerplant nacelle armor – 687lbs of steel and duraluminum deflector plate
Total aircraft armor – 2,154lbs

Nevertheless, there was a further hold up while waiting for parts to repair the chin turret, so the AAFPGC's focus shifted to testing the USMC power-operated tail gun as per a Wright Field directive. The evaluation showed that this turret had a greater effective range than the hand-held flexible tail guns then fitted in the B-17F as standard. The USMC turret had an "aided tracking" feature, as it operated on the basis of space control plus an added increment of rate control.

RIGHT
The Sperry top turret on the B-17 series continued to evolve during production, resulting in fewer ribs and larger expanses of glass and Plexiglas. (Boeing/Frederick A. Johnsen Collection)

The electrically powered Bendix chin turret had two 0.50-cal M2 machine guns equipped with a recoil absorbing mechanism, firing solenoids, and manual gun chargers. It was considered to be one of the easiest to operate by bomber gunners as it had a minimum of switches and controls and no fuses or reset buttons. The early examples fitted to the YB-40 (including this one) proved to be troublesome, however, in respect to their late delivery and installation. Fortunately, they were effective against head-on attacks and became a standard fit on the next generation B-17G. The turret's gunsight can be seen near the top of the Plexiglas nose. (USAAF)

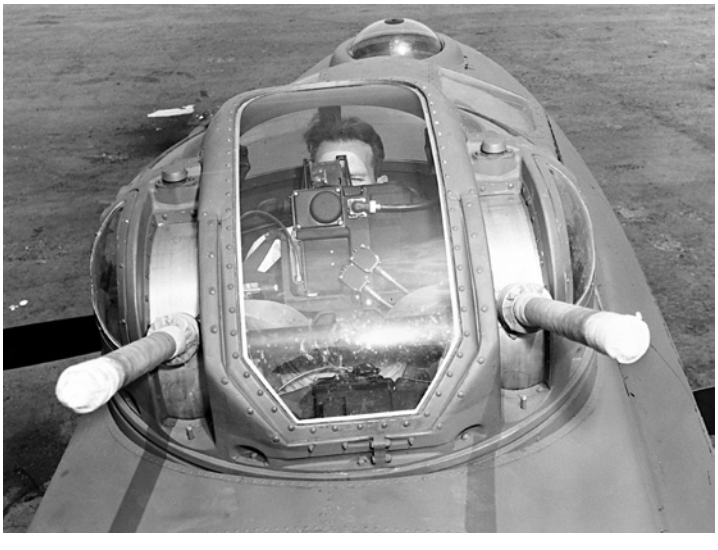
In space control alone, if the controls were displaced ten degrees, the guns were also displaced ten degrees and, at the same time with incremental rate control, they tracked at a rate of five degrees per second. During testing the turret was set up for space control only.

Once the chin turret became available tests were immediately run, and its scores indicated that the installations in both the XB-40 and XB-41 had their advantages. However, scoring for the XB-40 was flawed by the chin turret's left gun coming loose from its rear mounting bracket during the final tests. The resulting backlash in the azimuth drive gears of the sighting mechanism resulted in poorer scores. Once these problems were corrected the B-17F/XB-40 chin turret was believed to have the following advantages over the B-24D/XB-41:

1. The XB-41 transferred turret-firing vibration to the gunsight.
2. The XB-40 turret could be fired by another crew member when the bombardier was using the bombsight.
3. The standardization of the Bendix chin turret installation was more flexible in the XB-40 as it could be installed with less reworking of the nose structure.
4. The XB-40 chin turret had 180-degree azimuth field of fire, while the XB-41 was restricted to a 150-degree azimuth.

Official firing tests on the ball turret installation were not completed due to a lack of time and difficulty with gun stoppages. The turret was extended and retracted successfully on each mission and extensive tracking and free firing of these guns was carried out.

The memo concluded that the chin turret was a "definite step forward in providing frontal protection," while Brig Gen Muir Fairchild stated that "Eglin appeared to approve heartily of the chin installation." On September 18, after these tests were completed, Maj Wheeler and Capt Lang, both from the AAFPGC at Eglin Field, returned the XB-40 to the Vega plant.



Eleven days later, CTI-930 expedited the completion of the XB-40 at Vega and then its return to Eglin Field as soon as possible for complete turret and aircraft evaluation tests. The impetus for the early completion of the tests was its promotion by Brig Gens

Muir Fairchild and Eugene Eubank, the latter being the USAAF's Director of Bombardment. CTI-930 also allotted six additional B-17F airframes for escort conversion, the bombers being provided by the Production Engineering Section, under the command of Col Donald Putt, at Wright Field. Since work had already begun on testing the first XB-40, it was considered possible to convert all six B-17s by April 1943. CTI-930 also allotted seven B-24D airframes for conversion into bomber escorts.

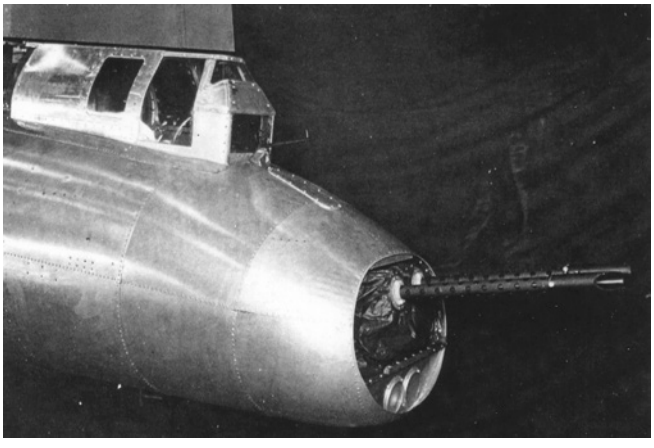
On October 11, Brig Gen Fairchild requested that 13 YB-40s be converted to XB-40 standard, instead of just the six B-17Fs approved by CTI-930. An important caveat was that these conversions had to have sufficient ammunition for four minutes' worth of firing by the tail gun. This would require ammunition stowage forward of the tail in the fuselage and installation of ammunition tracks with power boosters to transport the rounds to the guns. If the tracks were not deemed feasible, "some other quick mechanical means of transporting the ammunition to the tail gunner, providing the loading can be done with reasonable speed", had to be found.

Fairchild classed this project as a "modification" in order to secure it an AAA priority rating, and he urged that the completion and final tests of the XB-40 be expedited as "the importance of the whole project rests on the fact that it might have a deciding influence on extending our present penetration into enemy territory." Fairchild's assertion was backed by Maj Gen Spaatz, who stated that the Eighth Air Force's fighter escort cover for VIII Bomber Command had reached its range limits, and that "these planes [XB-40s] were necessary to permit deeper penetration into enemy territory on daylight raids."

Fairchild's 13 additional B-17s were to be procured under CTI-930 Addendum No. 1, dated October 15, from the Eighth Air Force's B-17F replacement allotment. Bearing the serial numbers 42-5732 through 42-5744, they were to be converted by the Douglas Modification Center in Tulsa, Oklahoma, using aircraft and data provided by Vega. The latter would "cooperate to their utmost" and have two special representatives at the center coordinating and expediting the project. The aircraft were to be supplied to the center by no later than November 20, with Vega also furnishing engineering and shop supervisory personnel.

Prior to the airframes arriving in Tulsa, Vega was to remove surplus parts during their assembly at Burbank so as to expedite their modification in Oklahoma. The company was also to supply one set of sample parts required for the modification, with the remainder being fabricated at the Douglas center. Shipment of all GFE was to begin immediately. By and large, the YB-40s were to be similarly equipped to the XB-40, with only a few minor changes.

The XB-40's dorsal fuselage deck was faired and streamlined for the installation of the additional Martin rear turret. Also seen in this view is the partially retracted Briggs Sperry ball turret. The XB-40 was the only Flying Fortress ever built to have a partially retractable ball turret. The XB-40 and a number of the YB-40s in the first batch had "Mickey Mouse" artwork applied mid-fuselage shortly after their completion. (USAAF)



The USMC power-operated tail guns had a greater effective range than the hand-held flexible tail guns they replaced in the standard B-17F tail enclosure (seen here). This installation necessitated the enlargement and general reworking of the standard F-model tail cone. The gunner knelt to fire the weapons, having a bicycle-type seat to rest on. (USAAF)

A tentative delivery date of March 1, 1943 was set to complete the 13 Tulsa conversions. However, the following caveat was included:

"Due to the fact that all 13 airplanes will essentially be at the Modification Center at one time, it may appear at times to casual observers that work would seem to be lagging."

The first YB-40 was received by Douglas on November 1, and by the 23rd of the month all 13 had been delivered.

ADDITIONAL ARMAMENT TESTING

On November 13, 1942, Col C. A. Horn, Acting Director of War Requisition and Movement, requested that additional XB-40 armament tests with a full combat crew, ammunition, and fuel load be performed by the AAFPGC at Eglin Field. Also, the aircraft's general flying characteristics and performance (take-off and landing distances, maneuverability, effect on speed and ceiling, and effect on center-of-gravity) when fully loaded were to be evaluated. The XB-40 duly arrived at Eglin Field on November 19 for testing.

The armament tests included:

1. Determining the maximum amount of ammunition carried and the time and length of fire from each turret and gun position.
2. Determining the fields of fire and the operation and efficiency of power boost mounts in the waist and tail gun positions.
3. The operation of the retracting mechanism of the Briggs Sperry ball turret at all altitudes and the effect of the bomber's speed with the turret extended and retracted.
4. Determining defensive blind spots during simulated fighter attacks.
5. Determining the disposition of armor plate in the turrets and gun positions.
6. Studying the use of ammunition tracks for feeding extra ammunition, especially to the tail turret.

At the conclusion of these tests the AAFPGC recommended the number and disposition of bomber escorts to accompany the conventional B-17s, after which the XB-40 was scheduled to be returned to Tulsa to be used as a sample for the YB-40s.

The results of the Eglin Field armament tests caused Brig Gen Eubank to request the relocation of the right waist gun 40 inches forward so that the port and starboard positions were staggered, giving the gunners more area to maneuver their weapons. Although this modification would probably delay the delivery of the 13 YB-40s, it was highly probable that the USMC tail guns would also arrive late in any case. Vega engineering was given top priority to begin the waist modification, with the actual relocation accomplished at the company's

Burbank plant rather than in Tulsa, as Vega had better facilities and more personnel in California.

Following the completion of the armament testing the XB-40 was flown directly from Eglin Field to Tulsa, despite Eubank's urgent request for changes to the waist gun positions. It would remain here for more than a week, before proceeding to Burbank. Once at the latter site, Vega estimated it would require up to 15 days (through to December 21) for the actual changes to be made. The work was to be given "all possible priority."

Although the YB-40s carried the Vega V-139-3 model number, the company had higher-priority production contracts, so the airframes were actually converted into bomber escorts by the Douglas Modification Center in Tulsa, Oklahoma. This photograph shows 12 of the original 13 YB-40s lined up awaiting installation of their Bendix chin turrets. The radio compartment rear decking has already been removed prior to the fitting of Martin 250 CE4 rear dorsal turrets. (USAAF)

A full month would be lost before the XB-40 was returned to Tulsa from Burbank to serve as a production sample for the YB-40s. Despite the changes requested for the powered side turrets and the delay in the supply of the USMC tail turret (the latter would not be available until March 15, 1943), Vega felt that the agreed XB-40 schedule could be maintained with the following minor alterations:

1. Meet the February 21, 1943 delivery date with YB-40s identical to the XB-40, except with single hand-operated side guns in the waist positions and the present Boeing twin tail gun. There were to be 13 standby tails modified for powered tail mounts when available, and these would be installed later.
2. Meet the April 1 delivery date with the YB-40s exactly identical to the XB-40.

On November 28, 1942, Col Marvin Gross requested to be informed as to a delivery date so that a directive could be issued and a schedule distributed as soon as possible. By December 7, Col Gross was even more anxious to meet the February 21 YB-40 delivery date, and he pushed USMC to achieve this goal. Irrespective of this being achieved, numerous other modifications still needed to be studied, particularly in respect to the installation of armor for the crew and vital aircraft systems. Accordingly, an anxious Wright Field Armament Laboratory dispatched a representative to Tulsa to evaluate this aspect of the aircraft.

Also, Brig Gen Eubank had been assured that the XB-40 would continue to retain bombing provision. In order to achieve this, it was recommended that the aircraft not be loaded to a gross weight of more than 60,000lbs, unless fuel tanks were installed on the wingtips. At this weight 6,600lbs of bombs could be carried, ammunition capacity

This YB-40 promotional photograph shows three turrets and a double-gun waist position bringing eight 0.50-cal machine guns to bear in the same direction. When the aircraft was fully loaded with ammunition, the guns' combined firepower potential was nearly 14,000 rounds. (Lockheed Martin Skunk Works/Peter M. Bowers/ Frederick A. Johnsen Collection)

would be 575 rounds per gun, and fuel load would be 1,700 gallons, giving the escort a range of 1,541 miles. This compared to the original design specifications of 58,000lbs gross weight, 800 rounds per gun, no bombs, and a range of 2,460 miles. The aircraft would be manned by 11 crew, including the new position of ammunition stoker.

Prior to the delivery of the first 13 YB-40s, CTI-1051, dated 27 November 1942, directed the procurement of 13 sets of dummy armament so that a limited number of conventional B-17Fs could be modified to appear as if they were escorts and yet continue to function as bombers. However, Materiel Command believed that an effort to camouflage standard Flying Fortresses in the formation would not be very effective, and that the ruse would quickly be detected since it was impossible to make dummy equipment appear operational without increasing aircraft weight and, consequently, losing performance. Nonetheless, after considerable research and debate concerning the best configuration to employ the dummy equipment, it was duly fabricated. However, there are no records to confirm whether this equipment was ever delivered, let alone tested.

DOUGLAS TULSA YB-40 CONVERSION CONTRACT

LEFT
Having enough room for the two back-to-back waist gunners was always a problem in the B-17E/F, as the waist windows were directly opposite each other as seen here. Although this was also the case in the XB-40, in the YB-40s the right window was staggered three airframes forward in the fuselage during their modification by Douglas. Staggered waist windows would not appear in B-17Gs until 1944 – the Douglas plant switched in March, Boeing in April, and Vega in May. Single-sheet Plexiglas waist window enclosures also appeared at about the same time. (USAAF)

On January 2, 1943, the Douglas Aircraft Company of Santa Monica, California, submitted a cost estimate for a Contract Modification (W535 ac-34456) for 13 YB-40s. Total cost for this work was to be $451,750 ($34,750 per unit), with a fixed fee of $18,070 (total $469,820). These figures were finally approved on April 19, by which point the company had completed the modification of the 13 YB-40 aircraft at Tulsa for an approximate total cost of $405,600, including a fixed fee that did not exceed four per cent of the estimated cost.

As a result of the increase in the YB-40 order from six to thirteen aircraft, it was decided that the project should be overseen by the Production Engineering Section. The latter was to be loaned XB-40 personnel for the duration of the program.

As previously noted in this chapter, rather than constructing a service test aircraft at Vega, which had experience in building and engineering

the bomber escorter, the YB-40s were to be converted by Douglas at its Tulsa Modification Center. There were two reasons for this. Firstly, Vega feared that taking on the YB-40 program at Burbank would cause serious delays in its standard B-17 production, and secondly, Douglas's Tulsa facility was not very busy at the time.

On January 22, a Change Order was issued to provide $53,491 to Vega for "additional services" it had provided during the conversion of the 13 B-17Fs to YB-40s. These included the supply of engineering information such as blueprints and photographs, and the posting of four Vega engineers and two customer service personnel to Tulsa – the former to oversee the dissemination of technical information with Douglas and the latter to coordinate the flow of experimental data.

Four days later, on January 26, Col Marvin Gross established a production schedule that would see two YB-40s delivered per month for six months from March 1943 in order to allow the service test squadron to maintain an adequate number of operational aircraft for type evaluation. Air Service Command at Patterson Field, Ohio, was assigned the task of modifying these aircraft, rather than Douglas Tulsa. Materiel Command had strong objections to giving the YB-40 modification work to Air Service Command, stating that the latter lacked the know-how developed by the Douglas Tulsa center at great cost in time and money.

Furthermore, accomplishing the work at a rate of two aircraft per month would not only prolong the project unnecessarily, it would make the efficient reallocation of now-idled Douglas Tulsa personnel extremely difficult. After heated discussions it was decided that Douglas Tulsa would modify all 12 aircraft in six months.

The delivery date for the USAAF to receive the first YB-40 by was set for February 21, 1943, although Materiel Command issued an advisory that "in spite of repeated efforts made to hold to this completion date on the first article, it will be missed by about two weeks." The delay was blamed on the "many shortages existing on these aircraft caused by stripping them to wind up the B-17

This view of the Tulsa Modification Center shows the YB-40s, with their chin and dorsal rear turrets installed, lined up behind B-25Ds, Mitchells and A-24B Banshees awaiting completion. (USAAF)

modification program in Tulsa." The delivery of the first aircraft took place on February 28, with the 13th being handed over exactly two weeks later. Vega had produced the XB-40 in three months and 22 days, starting with an airframe that had already been modified with the installation of a mock-up chin turret and a new tail cone adapted for the USMC gun mount. Thanks to this head start, and despite numerous changes to the subsequent design, Douglas Tulsa was able to finish 13 YB-40s in this time. Although their delivery did not meet the USAAF's February 21 deadline, the completion of the aircraft in such a short time frame was certainly to Douglas's and Shop Superintendent A. P. McCulloch's credit.

YB-40 TACTICAL TRIALS AND TRAINING

Lt Col Paul Tibbets, who would later captain the B-29 that dropped the "Little Boy" atomic bomb on Hiroshima on August 6, 1945, was tasked with evaluating the YB-40 while serving with the USAAF's School of Applied Tactics. In his April 20 report, titled *The Tactical Trials of the YB-40*, Tibbets was of the opinion that the YB-40 could be used as an escort if it were kept within the formation. New pilots should be thoroughly instructed as to the YB-40's unfavorable center-of-gravity situation, and new brakes needed to be installed.

Tibbets further believed that although the YB-40 was flawed, the concept should not be discarded as the aircraft could be "used as the basis for planning the bomber escort of the future." His report also included a list of changes to be made by frontline units prior to them flying their first mission with the YB-40.

Test results from the AAFPGC trials at Eglin Field were also sent to a number of senior officers within various bombardment groups in early 1943. Amongst the recipients was Lt Col J. T. Connally, commanding officer of the 9th BG, which was part of the USAAF School of Applied Tactics at Orlando Field, Florida. The three squadrons within the 9th flew B-17s, B-24s and B-26 Marauders to train crews in organization and operations for the 44 frontline bomb groups. Connally stated that "the YB-40 is a suitable escort fighter for the B-17F type airplane." He also made the following suggestions for its future operation:

1. 7,000ft runways to be utilized for safety reasons.
2. Use the YB-40 as a lead aircraft in the B-17 bombardment formation until just before the bombing run, when it was to exchange positions with a conventional B-17.
3. Replace the chin turret zippers with a metal slide because of icing problems.
4. Install new brakes.

Following their completion and acceptance by the USAAF, all 13 YB-40s were assigned to the Second (Training) Air Force, headquartered at Fort George Wright, in Spokane, Washington. The Second Air Force duly requested that all YB-40 personnel, aircraft, and "training devices" be sent to Biggs Field, in El Paso, Texas. Upon receipt of this news, the Eighth Air Force immediately sent four experienced pilots –

Maj Robert Keck and Capts George Ott, Richard Pugh, and George Griffin – from Britain to the US to serve as flight leaders in the direction of pilot and co-pilot training. A small cadre of qualified mechanics accompanied them. Finally, nine enlisted men were also assigned to check out combat crews.

Two USMC representatives arrived at Biggs to supervise instruction on the experimental power-operated tail and side gun mounts, and they subsequently accompanied the aircraft to Britain. Capt Briggs of Air Service Command's Armament Section would also accompany the YB-40 squadron across the Atlantic. The presence of such equipment specialists meant that if the new weaponry installed in the aircraft was accepted for frontline service, the personnel responsible for maintaining it would be familiar with troubleshooting any problems that were likely to occur.

Extremely stormy weather was encountered at Biggs Field for much of March 1943, and this affected flight training and the maintenance of the experimental equipment to such an extent that the YB-40 squadron was moved to Montbrook, Florida, for crew training and tactical suitability trials.

Lt Col Paul Tibbets of the USAAF's School of Applied Tactics led the team that evaluated the YB-40 in early spring 1943. (USAAF)

YB-40 PRODUCTION

A total of 22 YB-40s would eventually be completed, 13 of which were sent to Alconbury, in Cambridgeshire, for (although only 12 made it to the airfield) the 92nd BG's 327th BS. The brief service histories of the 13 deployed YB-40s are as follows:

B-17F/YB-40 42-5732 *THE MUGGER*
Delivered to Tulsa, Oklahoma, on October 29, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 15, 1943, then on to Orlando, Florida, on April 29, 1943, and Presque Isle, Maine, on May 3, 1943. Assigned to the 327th BS/92nd BG at Alconbury, Cambridgeshire, it crash-landed near the village of Brenish on the Isle of Lewis in the Outer Hedrides of Scotland on May 7, 1943. Aircraft was salvaged and taken to Stornoway, before being returned to the US on March 28, 1944. Assigned to the 3036th Base Unit (BU) (Flexible Gunnery School) at Yuma, Arizona, on May 4, 1944. Delivered to the Reconstruction Finance Corporation (RFC) for reclamation – sold for scrap – at Ontario, California, on May 18, 1945.

B-17F/YB-40 42-5733 *PEORIA PROWLER*
Delivered to Tulsa, Oklahoma, on October 29, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 18, 1943, then on to Montbrook Field, Florida, on March 31, 1943 and Presque Isle, Maine, on April 30, 1943. Assigned to the 327th BS/92nd BG as UX-F at Alconbury, Cambridgeshire, it was transferred to the 322nd BS/91st BG as LG-T at Bassingbourn, Cambridgeshire, on July 16, 1943. Salvaged on March 20, 1944, the aircraft returned to the US on September 5, 1944 and was assigned to the 3036th BU at Yuma,

Arizona. Transferred to Williams Field, Arizona, on September 26, 1944, it went to the RFC for reclamation at Ontario, California, on May 18, 1945.

B-17F/YB-40 42-5734 *SEYMOUR ANGEL/RED BALLOON/ OLD IRONSIDES*
Delivered to Tulsa, Oklahoma, on October 29, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 15, 1943, then on to Presque Isle, Maine, on May 6, 1943. Assigned to the 327th BS/92nd BG as UX-D at Alconbury, Cambridgeshire, on May 14, 1943, it was transferred to the 323rd BS/91st BG as OR-R at Bassingbourn, Cambridgeshire, on July 16, 1943. Returned to the US, it was sent to Eglin Field, Florida, on September 4, 1944, then on to the 3036th BU at Yuma, Arizona, on May 4, 1945. It then went to the RFC for reclamation at Ontario, California, on May 19, 1945.

B-17F/YB-40 42-5735 *WANGO WANGO*
Delivered to Tulsa, Oklahoma, on October 20, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 15, 1943, then on to Montbrook Field, Florida, on March 31, 1943, and Presque Isle, Maine, on May 4, 1943. Assigned to the 327th BS/92nd BG as UX-B at Alconbury, Cambridgeshire, on May 4, 1943, it was listed as missing in action on June 22, 1943 during the attack on the IG Farben Industrie Chemische Werke synthetic rubber plant at Hüls, in the Ruhr. Damaged by flak, it was then shot down by Fw 190 pilot Unteroffizier Bernhard Kunze of *Jagdgeschwader* (JG) 1 over Pont, Germany. All ten crew survived and were captured.

B-17F/YB-40 42-5736 *TAMPA TORNADO*
Delivered to Tulsa, Oklahoma, on November 5, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 14, 1943, then on to Orlando, Florida, on April 5, 1943, and Presque Isle, Maine, on May 3, 1943. Assigned to the 327th BS/92nd BG as UX-C at Alconbury, Cambridgeshire, on May 14, 1943, it was transferred to the 359th BS/303rd BG as BN-Q at Molesworth, Cambridgeshire, on August 3, 1943, then to the 524th BS/379th BG as WA-P at Kimbolton, Cambridgeshire, on August 28, 1943, and to No. 1 Base Air Depot at Burtonwood, Lancashire, on October 9, 1943. Returned to the US on March 28, 1944, it was sent to the 3010th BU at Williams Field, Arizona, on September 26, 1944, and then on to the RFC for reclamation at Ontario, California, on May 18, 1945.

B-17F/YB-40 42-5737 *DAKOTA DEMON*
Delivered to Tulsa, Oklahoma, on November 4, 1942, it was sent to Biggs Field, Fort Bliss, El Paso, Texas, on March 14, 1943, then on to Orlando, Florida, on April 30, 1943, and Presque Isle, Maine, on May 3, 1943. Assigned to the 327th BS/92nd BG as UX-K at Alconbury, Cambridgeshire, on May 11, 1943, it was transferred to the 360th BS/303rd BG as PU-Q at Molesworth, Cambridgeshire, on

July 16, 1943, and then to VIII Air Service Command on October 10, 1943. Returned to the US on November 2, 1943, it was salvaged on January 6, 1946.

B-17F/YB-40 42-5738 *BOSTON TEA PARTY*
Delivered to Tulsa, Oklahoma, on November 4, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 18, 1943, Orlando, Florida, on April 28, 1943, then Presque Isle, Maine, on May 1, 1943. Assigned to the 327th BS/92nd BG as UX-G at Alconbury, Cambridgeshire, on May 4, 1943, it returned to the US on November 2, 1943. Sent to the 3036th BU at Yuma, Arizona, on May 4, 1944, it then went to the RFC for reclamation at Ontario, California, on May 24, 1945.

B-17F/YB-40 42-5739 *LUFKIN RUFFIAN*
Delivered to Tulsa, Oklahoma, on November 6, 1942, it was flown to Biggs AFB, Fort Bliss, El Paso, Texas, on March 15, 1943, Montbrook Field, Florida, on April 1, 1943, and Presque Isle, Maine, on April 30, 1943. Assigned to the 327th BS/92nd BG as UX-J at Alconbury, Cambridgeshire, on May 4, 1943, it transferred to the 427th BS/303rd BG as GN-J at Molesworth, Cambridgeshire, on July 16, 1943, joined the 545th BS/384th BG as JD-P at Grafton Underwood, Northamptonshire, on August 28, 1943, and was sent to No. 1 Base Air Depot at Burtonwood, Lancashire, on October 12, 1943. Returned to the US on November 3, 1944, it joined the 3036th BU at Yuma on May 4, 1944 and was eventually sent to the RFC for reclamation at Ontario, California, on May 18, 1945.

B-17F/YB-40 42-5740 *MONTICELLO*
Delivered to Tulsa, Oklahoma, on November 7, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 19, 1943, Montbrook Field, Florida, on April 1, 1943, and Presque Isle, Maine, on April 30, 1943. Assigned to the 327th BS/92nd BG as UX-E at Alconbury, Cambridgeshire, on May 4, 1943, it returned to the US on November 2, 1943. Transferred to the 3010th BU at Williams Field, Arizona, on September 9, 1944, then to the 3036th BU at Yuma, Arizona, on May 4, 1945, it was sent to the RFC for reclamation at Ontario, California, on May 18, 1945.

Recently arrived YB-40s sit on the grass at Alconbury in May 1943, each of the aircraft having been marked with the "UX" unit code unique to the 327th BS. The YB-40 closest to the camera, 42-5736, was christened *TAMPA TORNADO* while in the ETO. (USAAF)

B-17F/YB-40 42-5741 *CHICAGO/GUARDIAN ANGEL*
Delivered to Tulsa, Oklahoma, on November 12, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 17, 1943, Montbrook Field, Florida, on March 31, 1943, and Presque Isle, Maine, on April 30, 1943. Assigned to the 327th BS/92nd BG as UX-H at Alconbury, Cambridgeshire, on July 7, 1943, it was transferred to the 401st BS/91st BG as LL-Y at Bassingbourn, Cambridgeshire, on July 22, 1943. Returned to the US on November 2, 1943, it went to the 3036th BU at Yuma, Arizona, on May 4, 1944 and then to the RFC for reclamation at Ontario, California, on May 8, 1945.

B-17F/YB-40 42-5742 *PLAIN DEALING EXPRESS*
Delivered to Tulsa, Oklahoma, on November 15, 1942, it was flown to Montbrook Field, Florida, on March 31, 1943, and Presque Isle, Maine, on April 30, 1943. Assigned to the 327th BS/92nd BG as UX-L at Alconbury, Cambridgeshire, on May 13, 1943, it was transferred to No. 1 Base Air Depot at Burtonwood, Lancashire, on October 5, 1943. Returned to the US on April 3, 1944 and transferred to the 3036th BU at Yuma, Arizona, on May 4, 1944, it was eventually sent to the RFC for reclamation at Ontario, California, on May 18, 1945.

B-17F/YB-40 42-5743 *WOOLAROC*
Delivered to Tulsa, Oklahoma, on November 15, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 14, 1943, Orlando, Florida, on April 28, 1943, and Presque Isle, Maine, on May 3, 1943. Assigned to the 327th BS/92nd BG as UX-M at Alconbury, Cambridgeshire, on May 11, 1943, it was transferred to Iceland on June 23, 1943, but returned to Alconbury on July 25, 1943. Sent to No. 1 Base Air Depot at Burtonwood, Lancashire, on October 5, 1943, it returned to the US and was assigned to the 3036th BU at Yuma, Arizona, on October 11, 1943. It was sold for reclamation on November 8, 1944.

B-17F/YB-40 42-5744 *DOLLIE MADISON*
Delivered to Tulsa, Oklahoma, on November 18, 1942, it was flown to Biggs Field, Fort Bliss, El Paso, Texas, on March 17, 1943, Montbrook Field, Florida, on March 31, 1943, Orlando, Florida, on April 27, 1943, and Presque Isle, Maine, on May 5, 1943. Assigned to the 327th BS/92nd BG as UX-A at Alconbury, Cambridgeshire, on May 11, 1943, it was sent to No. 1 Base Air Depot at Burtonwood, Lancashire, on October 5, 1943, and returned to the US on February 24, 1944. It joined the 3036th BU at Yuma, Arizona, on May 4, 1944, and was sent to the RFC for reclamation at Ontario, California, on May 18, 1945.

B-17F/YB-40 conversions 42-5920, -5921, -5923, -5924, -5925, and -5927 were not deployed to Britain to serve with the Eighth Air Force, and neither were B-17F/TB-40 conversions 42-5834, -5872, and -5926. TB-40 42-5833 was deployed to Britain for evaluation, but it was not used in combat. The brief service histories of these aircraft are as follows:

YB-40 42-5741 *CHICAGO* shows signs of use in this summer 1943 photograph, with what appears to be weathering beneath the "UX" fuselage code. The latter was applied in exactly the same location as the Disney figures worn by the YB-40s sent to the 92nd BG, so this could well be the remnants of that artwork. Note the toned down gray star in the national insignia. (USAAF)

B-17F/YB-40 42-5920
Delivered to Long Beach, California, on May 2, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 12, 1943. Sent to the 2126th BU at Buckingham, Florida, on June 8, 1944, to the 2126th BU at Laredo, Texas, on June 11, 1944, and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/YB-40 42-5921
Delivered to Long Beach, California, on May 11, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 15, 1943. Sent to the 333rd BU at Morris, North Carolina, on June 1, 1943, to the 35th FG at Page Field, Florida, on June 5, 1943, to the 2118th BU at Laredo, Texas, on August 10, 1944, to the 2126th BU at the same location on September 8, 1944, to the 4121st BU at Kelly Field, Texas, on May 22, 1945, back to the 2126th BU at Laredo on June 11, 1945, and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/YB-40 42-5922
Delivered to Long Beach, California, on May 16, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 21, 1943. Sent to the 2118th BU at Buckingham, Florida, on June 4, 1944, to the 610th BU at Eglin Field, Florida, on September 4, 1944, to the 2114th BU at Lockbourn, Ohio, on November 19, 1944, and to the RFC for reclamation at Altus, Oklahoma, on October 8, 1945.

B-17F/YB-40 42-5923
Delivered to Long Beach, California, on May 11, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 16, 1943. Sent to the 2118th BU at Laredo, Texas, on August 10, 1943, to the 2126th BU at the same base on September 8, 1943, and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/YB-40 42-5924
Delivered to Long Beach, California, on May 12, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 21, 1943. Sent to the 2126th

BU at Laredo, Texas, on June 3, 1944 and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/YB-40 42-5925
Delivered to Long Beach, California, on May 13, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 16, 1943. Sent to the 2118th BU at Laredo, Texas, on July 4, 1944, to the 2126th BU at the same location on September 8, 1943, and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/YB-40 42-5927
Delivered to Long Beach, California, on May 14, 1943 and converted into a YB-40 at Tulsa, Oklahoma, by May 21, 1943. Sent to the 2126th BU at Laredo, Texas, on June 11, 1944, then to the 610th BU at Elgin, Florida, on July 11, 1944, and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/TB-40 42-5833
Delivered to Long Beach, California, on March 11, 1943 and converted into a TB-40 crew trainer at Tulsa, Oklahoma, by June 15, 1943. Sent to Patterson Field, Ohio on July 19, 1943. Assigned to the 92nd BG at Alconbury, Cambridgeshire, during 10/43 for non-combat evaluation, with a revised Bendix chin turret and Cheyenne tail turret. Returned to the US and sent to Yuma, Arizona, on June 25, 1944, then to the 3036th BU at the same location on May 4, 1945, and to the RFC for reclamation at Ontario, California, on May 24, 1945.

B-17F/TB-40 42-5834
Delivered to Long Beach, California, on March 11, 1943 and converted into a TB-40 crew trainer at Tulsa, Oklahoma, by June 15, 1943. Sent to Wright Field, Ohio, on July 12, 1943, then to the 611th BU at Eglin Field, Florida, on June 8, 1944, to the 610th BU at the same location on November 12, 1944, to the 2137th BU at Hendricks, Florida, on November 14, 1944, and to the RFC for reclamation at Ontario, California, on December 19, 1945.

42-5925 was amongst the second batch of ten YB/TB-40s that did not see combat, remaining in the US and serving as trainers instead. The aircraft was assigned to the 2118th BU at Laredo, Texas, on July 4, 1944. While here, it was regularly used by the airfield's Aerial Gunnery School, trainee gunners firing at armored Bell RP-63 "Pinball" target aircraft. The YB-40 appears to have been stripped of all its armament bar two 0.30-cal guns in the Martin 250 CE4 dorsal turret. The latter fired special frangible rounds made of a lead/Bakelite combination that would disintegrate upon impact with the RP-63. (USAAF)

B-17F/TB-40 42-5871
Delivered to Long Beach, California, on April 5, 1943 and converted into a TB-40 crew trainer at Tulsa, Oklahoma, by April 10, 1943. Sent to the 3036th BU at Yuma, Arizona, on May 4, 1944, and then to the RFC for reclamation at Ontario, California, on May 18, 1945.

B-17F/TB-40 42-5872
Delivered to Long Beach, California, on April 5, 1943 and converted into a TB-40 crew trainer at Tulsa,

Oklahoma, by April 13, 1943. Sent to the 2137th BU at Hendricks, Florida, on October 13, 1944, and to the RFC for reclamation at Walnut Ridge, Arkansas, on December 19, 1945.

B-17F/TB-40 42-5926
Delivered to Long Beach, California, on May 13, 1943 and converted into a TB-40 crew trainer at Tulsa, Oklahoma, by May 21, 1943. Sent to the 2137th BU at Hendricks, Florida, on October 13, 1944, to the 2518th BU at Enid, Oklahoma, on September 20, 1945, and sold for reclamation on February 13, 1946.

After the 13 combat-bound YB-40s were delivered to the USAAF in March 1943, extensive changes were subsequently made both before and during Eglin Field combat tests. The YB-40s were deployed from the US to Britain via Presque Isle, Maine, Labrador, and Iceland. Seven left Presque Isle on May 7, followed by four more one week later. Two stragglers remained behind in Maine for repairs and adjustments, leaving on May 15 and 18, respectively.

As previously noted, only 12 YB-40s arrived in Britain. 42-5732 had flown from Presque Isle to Meeks Field at Goose Bay, Labrador, on May 7, where pilot 1Lt Paul Casey encountered poor weather conditions and decided to continue onward across the North Atlantic for Britain. He ran out of fuel, however, and force-landed in a peat bog near the village of Brenish on the Isle of Lewis in the Outer Hebrides of Scotland. The remaining 12 YB-40s successfully joined the 92nd BG at Alconbury from May 18, 1943.

In August of the previous year, the 92nd had been the first Eighth Air Force bomb group to use the Atlantic ferry route via Gander, in Newfoundland, to Prestwick, in Scotland, and then south to Bovingdon, in Hertfordshire. Here, the group exchanged its new B-17Fs for the E-models of the 97th BG, which was to conduct combat operations in support of the Operation *Torch* landings in North African in November 1942. At Bovingdon, the 92nd BG, under the leadership of Lt Col James S. Sutton, operated as VIII Bomber Command's Combat Crew Replacement Center.

In January 1943, following the diversion of bomb groups originally destined for the Eighth Air Force to North Africa, the 92nd BG was transferred to Alconbury. The latter airfield, in Cambridgeshire, had been opened in 1938 as a rudimentary satellite landing ground for RAF Upwood. Following the commencement of World War II, it was used as a temporary base for Blenheim IVs of No. 15 Sqn, which was assigned to RAF Wyton. During 1941 three new runways were completed, and the airfield was subsequently home to Wellingtons of Bomber Command's Nos. 40 and 156 Sqns in 1941–42. Both units flew nocturnal raids against Germany from the airfield.

In August 1942 Alconbury became the USAAF's Station 102 as part of the Eighth Air Force, its runways having been extended prior to the arrival of heavy bombers. The B-24D-equipped 93rd BG flew in from the US in early September, and the group undertook missions from Alconbury until it was sent to North Africa in early December on a temporary duty posting to support the Twelfth Air Force.

RIGHT
After initially hosting the B-24Ds of the 93rd BG from September 1942, Station 102, better known as Alconbury, welcomed the 92nd BG in January 1943. The group would fly all of its YB-40 missions from the Cambridgeshire airfield. (USAAF)

Lt Col James S. Sutton led the 92nd BG from its activation on March 1, 1942 until he was reassigned to the Northern Ireland Combined Command on May 2, 1943 – just days before the first YB-40s reached Alconbury. (USAAF)

Once the 92nd BG had taken up residence, it was again re-designated an operational bombardment group. At the Cambridgeshire airfield the group adopted the nickname "Fame's Favorite Few", and its B-17s were assigned the "Triangle B" tail code. When it first arrived at Alconbury, the 92nd had only eight old E-models on strength, these aircraft having previously been used as crew trainers by the group. Two Vega-built F-models arrived on April 20, followed by 12 more by month-end. However, eight of the B-17Fs were soon transferred elsewhere.

On May 2, in another bitter blow to the group, Lt Col Sutton, who had led the 92nd from its activation, was reassigned to the Northern Ireland Combined Command, and his air executive, Lt Col William Reid, was transferred to the 91st BG as its new CO. However, Lt Col Reid soon returned as CO of the 92nd, serving from May 23, 1943 to September 27, 1944. Finally, on May 14, 1943, the 92nd made its combat debut when it participated in an attack on the shipyards at Kiel. This raid was the first time VIII Bomber Command had been able to sortie more than 200 aircraft on one mission. Over the next few weeks the 92nd attacked strategic targets that included ball-bearing plants at Schweinfurt, submarine installations at Wilhelmshaven, a tire plant at Hannover, airfields near Paris, an aircraft factory at Nantes, and a magnesium mine and reducing plant in Norway.

YB-40 TACTICAL EMPLOYMENT

Upon their arrival in Britain, all 12 of the surviving YB-40s were assigned to the 92nd BG's 327th BS. The unit performed wide-ranging inspections and flight-testing of the bomber escorts, after which comprehensive modifications were made between May 5–15.

Once declared operational, the YB-40s filled the treacherous positions referred to as "Coffin Corner" that were assigned to the low squadron in the group formation. After several missions were flown in this manner, the YB-40s were separated and scattered throughout the whole combat wing. Their position in any particular combat group (box) was then determined by the Operations Officer under whose jurisdiction they happened to fall. Frequently, however, they would be placed in the Nos. 2 and 3 wing positions in any squadron within the 92nd BG in order to provide frontal protection with their chin guns while the bombardier in

the lead aircraft made his bombing run. Missions were flown from 21,000 to 27,000ft.

YB-40 crews soon voiced their displeasure about their possible fate, as they felt they were continually being assigned to fly in the formation "hot spots." This was, of course, the very purpose for which their heavily armed aircraft had been built. It was suggested, but not implemented, that one tour as part of the crew of a YB-40 would equal two in a conventional B-17.

Another contemplated use of the YB-40 was to protect crippled and straggling B-17s that had been forced to drop behind their protecting formations due to battle or mechanical damage, thus making them choice targets for enemy fighters. However, the YB-40s themselves were not all that invulnerable, and their utilization in this way did not justify the high probability of them also being shot down.

On May 19, after flying its fourth combat mission since being declared operational four days earlier, the 327th BS was forced to cancel all missions until the 29th because of persistent fog and rain. Finally, on May 29, the 92nd BG attacked the U-boat pens and locks at Saint-Nazaire, on the west coast of France. The YB-40s made their combat debut on this raid when seven of them accompanied 15 B-17s that were dispatched under the leadership of Maj William Cowart. Bombing results were good and there were no significant attacks by Luftwaffe fighters, but flak over the target was accurate.

While returning to base, the group's B-17s, divested of the weight of their respective bombloads (2,000lbs per aircraft), found themselves flying faster than the YB-40s. The latter were straggling due to their drag-inducing extra turrets and massive load of unused ammunition. Having been created to protect standard bombers in the formation, the bomber escorts now became the aircraft most in need of protection. Alarmed by this turn of events, the Eighth Air Force immediately sent all the YB-40s to VIII Air Service Command's 2nd Strategic Air Depot at Abbots Ripton, in Huntingdonshire, for modifications and weight reduction to increase their speed.

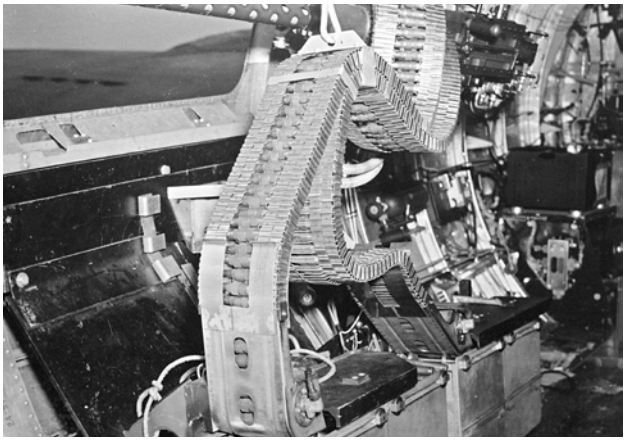
Innovation in respect to the bomber escorts' employment was also investigated. During this first mission, an element of three YB-40s had taken off after the group's standard B-17s had become airborne, and the bomber escorts then used too much fuel trying to catch them up. Following this episode, VIII Bomber Command decided to place the YB-40s within the departure stream of the B-17s they were to escort so that forming up would become a more routine affair.

It was not until mid-June that all the theater-modified YB-40s returned to combat following the solution of ammunition feed mechanism issues with both the waist guns and tail turret. The principal problem with the USMC turrets was failure of the booster motor to cut out when the guns stopped firing.

By then production of the YB-40 was on the cusp of being halted, the USAAF's Materiel, Maintenance, and Distribution Section notifying Materiel Command on June 3 that there was "no more requirement

Lt Col William Reid was Lt Col Sutton's air executive until he too was posted away from the 92nd BG in the spring of 1943 to take command of the 91st BG. He had returned to the 92nd by May 23, however, leading the group until September 27, 1944. (USAAF)

RIGHT
By June 1943 the ammunition boxes had been raised onto purpose-built stands so that the weapons could rely on gravity feed for their belted rounds, thus allowing the troublesome booster motors to be removed. (AFHRA/ Frederick A. Johnsen Collection)

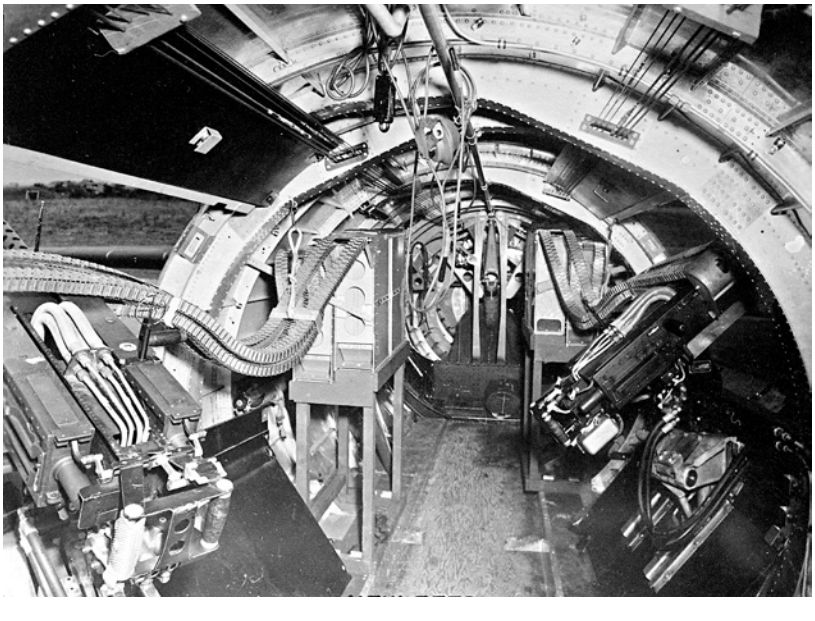


This detailed photograph shows the original YB-40 waist gun feed which depended on unreliable Hughes booster motors to draw rounds into the 0.50-cals from ammunition boxes mounted on the floor of the aircraft. Each of the latter contained 600 rounds, which were fed to the guns via flexible chuting. The booster motors were installed on top of the boxes, and they were actuated by micro-switches connected to the trigger mechanism so that they could feed the correct number of rounds to the weapons as required by the gunners. (AFHRA/Frederick A. Johnsen Collection)

for a bombardment escort airplane." Three days later, Brig Gen Oliver Echols, Chief of Materiel Command, who was also on the War Production Board, chaired a conference during which it was agreed that no more YB-40s "would be needed." Furthermore, all B-17s awaiting conversion at the Tulsa Modification Center were to be stripped and transferred to training units, except for two that were to be assigned to Materiel Command for "test purposes." Action on the YB-40 cancellation was to be initiated on July 13.

On June 21 Materiel Command issued CTI-1377 that discussed further modifications for future YB-40s being converted at Tulsa based on the handful of combat missions flown by the 92nd BG to date. Among the recommendations were:

1. Two extra inches of manifold pressure and 100 rpm were required for the YB-40s to remain in formation. However, this fix would require additional fuel consumption to be supplied by auxiliary bomb-bay tankage. This would also give the YB-40s enough fuel to escort standard B-17s to their maximum range.
2. Reduce the amount, and thickness, of armor plate in the waist and tail gun positions from ½-inch to ¼-inch.
3. Install remote instrument-reading components.
4. Add two 150-round ammunition boxes for each tail gun. Strengthen the ammunition tracks so that the booster motors did not distort and break them.
5. The ammunition capacity for the YB-40's waist guns was insufficient, and it was remedied by deepening the waist gun boxes so that each gun would supply 50 additional rounds. It was recommended to hang the boxes from the ceiling to obtain gravity feed, and this would also allow more rounds to be loaded into the hanging boxes. The waist guns' booster motors were inadequate and burned out too frequently for operational use. A British Mk IIIA reflector gunsight was recommended to replace the present ring and bead waist gunsight.



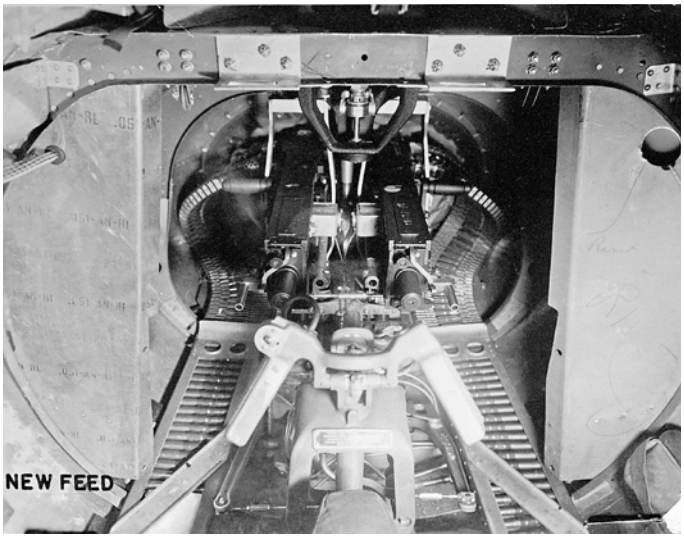
6. Modify the ball turret as per current modifications (on B-17E 41-9112). Increase the oxygen supply to the ball turret.
7. Extend the depth of each of the upper four 200-round ammunition boxes for the Martin dorsal rear turret in order to double their capacity to 400 rounds.
8. Provide the chin turret with increased ammunition without using the present unwieldy reloading procedures.
9. Retain the astrodome so that an astro compass reading could be made.

The day after CTI-1377 was issued, the first large-scale use of the YB-40 occurred during an attack on the strategically important IG Farben Industrie Chemische Werke synthetic rubber plant at Hüls, in the Ruhr. Led by Col Reid, the 92nd BG dispatched 29 aircraft, including 11 YB-40s, with 18 bombers attacking the Hüls plant with 500lb general purpose (GP) bombs. Upon crossing the Dutch coast inbound, about 30 enemy fighters made attacks, mostly from "11 through to 2 o'clock high," although they broke off their runs without success. Once the aircraft were in the target area approximately 50 fighters, approaching mostly from the rear, likewise failed to press home their attacks. Mission reports make no assertions that the lack of success for the enemy interceptors was due to the protecting YB-40s. Confirmed by post-attack strike photographs, bombing results were considered as excellent. Indeed, the synthetic rubber plant ceased production for a month.

Despite heavy flak causing battle damage to some aircraft, only one was lost by the 92nd BG –YB-40 42-5735 *WANGO WANGO*, flown by 1Lt Andrew Bilek and 2Lt William Carey. Two of the aircraft's engines had been damaged by flak over the target, and it was seen slowly descending under control near the Dutch border. Flying alone, the YB-40 was shot down by Fw 190 pilot, and nine-victory ace, Unteroffizier Bernhard Kunze of JG 1 over Pont, near Geldern in western Germany. Its ten-man crew survived and was taken prisoner.

On June 25 Maj James Griffith led 23 aircraft, including seven YB-40s (two of which later aborted), aloft on a mission blighted by poor weather almost from take-off. This in turn caused problems during formation assembly and primary target location, forcing the group to select a suitable alternative to attack instead. VIII Bomber Command had been tasked with targeting the Blohm & Voss U-boat shipyard in Hamburg-Steinwerder, but when it was found to be obscured by ten-tenths cloud, crews headed for the company's smaller facility at Oldenburg, 40 miles east-northeast of Bremen. It was attacked with 500lb GP bombs. Numerous enemy fighters were encountered, with gunners from the 92nd BG claiming four destroyed, one probable and four damaged – YB-40 crews claimed two destroyed and one damaged. All the group's Flying Fortresses returned safely to base.

Achieving hits from the waist gunners' positions was difficult, as enemy fighters would zoom by at great speed either from the rear of the aircraft or, as was often the case in 1943, from the front. This meant that great skill and a good deal of luck, in equal measure, were required if a hit was to be achieved from here. This USMC Type M-5 twin gun mounting was installed in the XB-40, its operator being provided with hydraulic power to help him swing the heavy weapons around. Single 0.50-cal mounts in B-17 bombers lacked any such aids for the gunner. (USAAF)



The YB-40's USMC tail guns also had their ammunition feed changed to the configuration seen here, allowing the removal of the Hughes booster motors. (AFHRA/Frederick A. Johnsen Collection)

The following day the 92nd BG participated in an attack on a Luftwaffe depot at Villacoublay and the airfield at Poissy, both targets being near Paris. When the five YB-40s assigned to the raid were unable to form up with the bombing squadron, they returned to base. No fewer than 103 B-17s also scrubbed, either failing to take off or aborting once airborne. Only 12 bombers from the 92nd attacked the primary target (Villacoublay) and six the secondary (Poissy). No aircraft from the group were lost, and B-17 gunners claimed three destroyed, one probable, and four damaged.

At 1700 hrs on June 28, ten B-17s armed with 2,000lb GP bombs and escorted by six YB-40s departed Alconbury as part of the 104 aircraft-raid dispatched by the 1st Bomb Wing (BW) against the U-boat pens and locks at Saint-Nazaire. The attack produced excellent results, with post-mission photographs revealing that the only serviceable lock entrance to the pens had been destroyed. Flak, as usual, was both heavy and accurate over the target, with the 92nd having one crewman killed and another wounded. All aircraft from the group returned safely, however, with six of them having minor battle damage. One enemy aircraft was claimed as destroyed, one probable, and one damaged by YB-40 gunners.

On the 29th, 12 B-17s and two YB-40s were dispatched (with one aborting) to the Luftwaffe depot at Villacoublay airfield once again. With ten-tenths cloud blanketing the target, all aircraft returned without dropping their bombs. Many enemy fighters were encountered but few pressed home their attacks, while B-17 gunners from the 92nd claimed two probables and one damaged. All aircraft from the group returned safely, with several having suffered only slight battle damage.

That same day, Col B. R. Brentnall of the Aircraft Modification Branch of the Production Division revealed that the YB-40s had an adverse center-of-gravity problem due to the inclusion of wingtip fuel tanks and an increase in the aft ammunition supply. The only way of solving this issue was to reduce the number of rounds available for the waist and tail guns.

NEXT PAGES

THE YB-40 IN ACTION

During the 48 sorties completed in mid-1943 by the 12 YB-40s assigned to the 92nd BG, gunners on board the bomber escorts claimed five German fighters shot down, two more probably destroyed, and a handful damaged. Two of the victories and one of those damaged came on the June 25, 1943 raid on Blohm & Voss's plant at Oldenburg, this mission proving to be the high point during the YB-40's brief operational career in the ETO with the Eighth Air Force.

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June 29 also saw Brig Gen Ira Eaker, Commanding General of the Eighth Air Force and an early advocate of the XB-40, issue the following statement after the YB-40s had flown a handful of missions with the 92nd BG and had been found to be generally unsatisfactory:

"I have been very worried about the YB-40. I had great hopes for that airplane and I was most loath to render a derogatory report and have sent it back for further tests on two occasions. Our tactical people insist that they do not want this airplane. Actually, the following are the facts surrounding the final report which is now on its way. The YB-40 in its present form is unsatisfactory. The principal reason is that it has different flight and performance characteristics than the standard B-17. There is some loss of crew morale in that they do not bomb and because they are always put into a hot spot. This, however, has not been sufficient to jeopardize the full employment of this airplane.

"We did not get it into the fight as quickly as we might have done because we found that the gunners upon their arrival had little training in high-altitude firing at aerial targets, and we could not put our own trained crews in because they were not familiar with four of the five turrets in the YB-40.

"We first tried out these airplanes in their own formations, leading the low combat wing, which generally bore the brunt of the fight. They messed up the formation due to differences in rate of climb and speed. We then picked two of these airplanes and put them on either wing of the leaders of each of the combat wings to protect them. They did not fly well with the leader because of the different performance characteristics. The plane is too heavy and should have a bombsight.

"Many of the YB-40's characteristics are absolutely solid – the chin turret is an excellent idea and the YB-40 does have additional firepower which often comes in handy. In yesterday's mission [June 28, 1943] a YB-40 went back to pick up a cripple, fought off the attacking fighters and brought him home. So, as you can see, we have a good idea, but we have not quite gotten the correct aircraft for carrying it out.

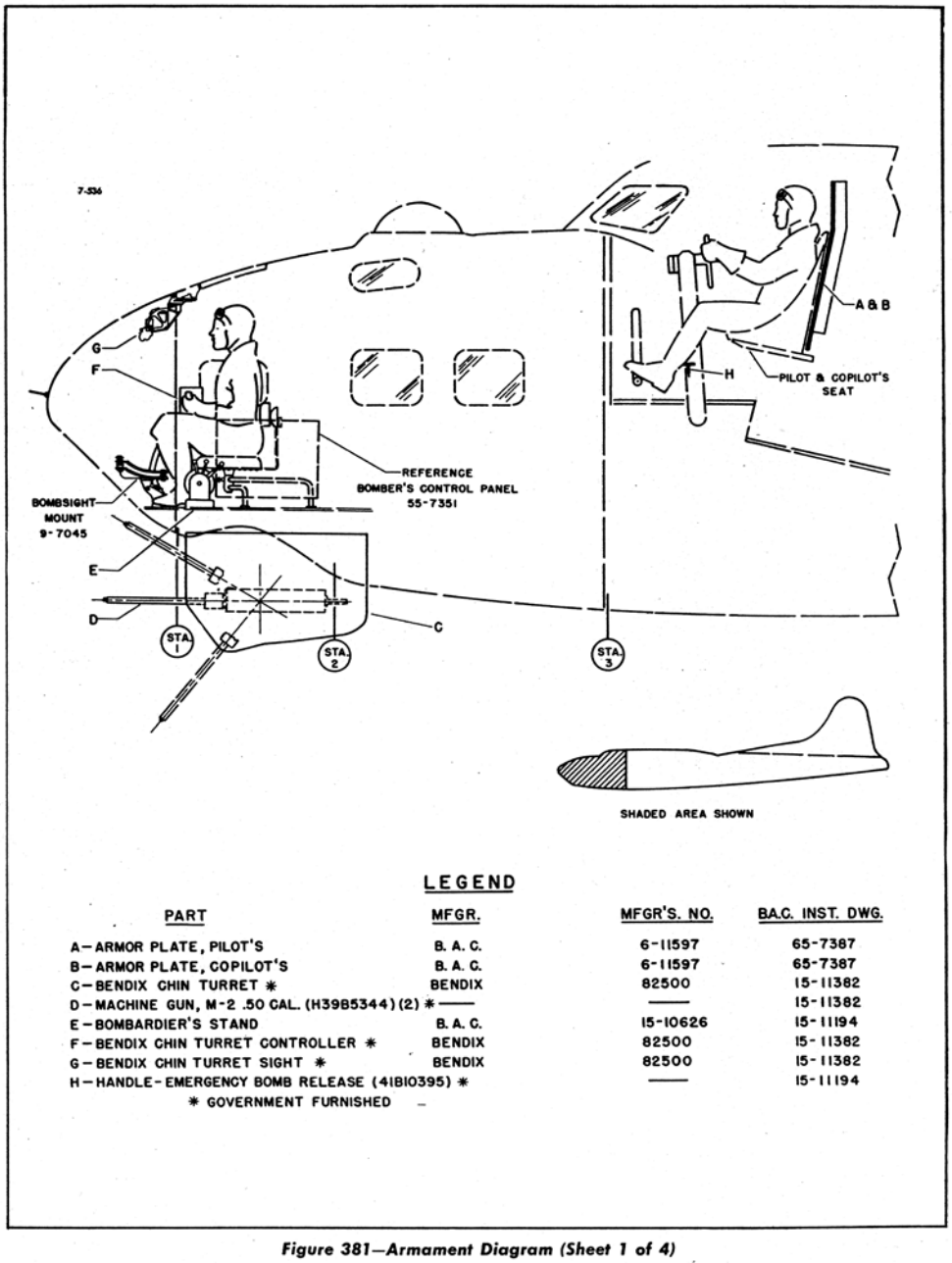
"We are quite certain now of two things; firstly, that we all want our bombers to carry bombs and make provisions for a bombsight in addition to the chin turret; and, secondly, that all airplanes in a combat formation must be homogenous in performance characteristics.

"Be assured that we are going to press on with the testing of this new airplane."

The next big raid for VIII Bomber Command came on July 4 when it was tasked with attacking aircraft factories at Nantes and Le Mans, in France, the force committed to the mission including 17 B-17s from the 92nd BG escorted by two YB-40s. Enemy fighter opposition was intense from the initial point in to the targets, and it continued relentlessly on the way out to about 30 miles beyond the French coast. One B-17 from the 92nd was lost, while gunners from the group claimed ten destroyed, one probable, and four damaged.

Three days later Col William Reid compiled his *Report on the YB-40 Aircraft*, recommending the following from the experience gathered during the first seven YB-40 operational missions:

Brig Gen Ira Eaker was an early advocate of the XB-40 during his time organizing VIII Bomber Command in the ETO in 1942. However, after the YB-40 proved to be unsuccessful in combat (by which point Eaker was Commanding General of the Eighth Air Force), he then strongly promoted improving the range of conventional fighters using drop tanks as bomber escorts. (USAAF)



LEGEND

PART	MFGR.	MFGR'S. NO.	BA.C. INST. DWG.
A—ARMOR PLATE, PILOT'S	B. A. C.	6-11597	65-7387
B—ARMOR PLATE, COPILOT'S	B. A. C.	6-11597	65-7387
C—BENDIX CHIN TURRET *	BENDIX	82500	15-11382
D—MACHINE GUN, M-2 .50 CAL. (H39B5344)(2) *	——	——	15-11382
E—BOMBARDIER'S STAND	B. A. C.	15-10626	15-11194
F—BENDIX CHIN TURRET CONTROLLER *	BENDIX	82500	15-11382
G—BENDIX CHIN TURRET SIGHT *	BENDIX	82500	15-11382
H—HANDLE-EMERGENCY BOMB RELEASE (41B10395) *		——	15-11194

* GOVERNMENT FURNISHED

Figure 381—Armament Diagram (Sheet 1 of 4)

B-17G artwork from a technical manual shows the relationship of the chin turret in the nose to the location of its gunner. This was the arrangement pioneered in the XB/YB-40. (Frederick A. Johnsen Collection)

Range: Because the YB-40 carried its total weight throughout the entire mission (except for ammunition and fuel expended, and carried no bombs to be dropped) its maximum safe range from take-off until its return to the English coast using the 1,700-gallon wingtip fuel tanks was six hours, while adding one bomb-bay tank saw the range increased to 7.5 hours.

Firepower: The YB-40 with twin waist guns, Martin dorsal turret, Bendix chin turret, and the conventional B-17F armament, was equipped with 16 guns, which gave it an estimated firing power of only 20 per cent more than the standard B-17F.

Effectiveness against the Enemy: In the ETO, the YB-40's effectiveness against the enemy was estimated as ten per cent more than the standard B-17F, mostly believed to be due to the Bendix chin turret.

Desirability: Both flying and planning officers felt that the YB-40's disadvantage of not carrying a bombload to the target outweighed any advantage of formation protection afforded by the YB-40. Since an estimated 75 per cent of all Luftwaffe fighter attacks were head-on, even with the Bendix chin turret, most of the YB-40's firepower was concentrated to its sides and rear, and the aircraft was considered to be ineffective. The added weight of the new Martin dorsal turret, the new twin waist guns, and new tail gun and all their associated ammunition had a definite negative effect on the YB-40's homeward, high-altitude performance after the escorted bombers had dropped their bombs and comparatively raced back to base. These new gun installations were considered "not to be warranted in future B-17s." The Bendix chin turret was considered a "good installation and has proven to be much more accurate and effective than the conventional B-17 nose gun. Therefore, the YB-40 is undesirable in this Theater [ETO]."

Ditching Procedure: The YB-40 had no satisfactory ditching procedure, as its radio compartment was occupied by the Martin dorsal turret and the waist gun window exits were filled by the twin 0.50-cal installations.

Recommendations:

1. No additional YB-40s to be sent to the ETO.
2. Any future B-17 models to be equipped with the Bendix chin turret, fitted with computing gunsights if possible.
3. Continue the staggered waist gun configuration.
4. Install the N-6 reflector gunsight on flexible waist and tail guns.
5. YB-40s in Britain to be converted back to standard B-17s, keeping their chin turrets but removing the Martin turret, twin waist guns (keeping them as single flexible mounts) and all extra armor plate.

On July 8 now Brig Gen F. O. Carroll, Chief of the Engineering Division at Wright Field, sent a priority message to Col S. R. Brandshaw, Chief of the Production Branch of the Materiel, Maintenance, and Distribution Section, giving him permission to halt work on the current YB-40s at Tulsa.

Two days later, 11 B-17s from the 92nd BG, escorted by five YB-40s, attacked Caen–Carpiquet airfield, in France. Weather prevented target identification, however, and no bombs were dropped. Enemy fighter opposition was light and ineffective and B-17 gunners made no claims.

On July 13 HQ Materiel Command issued CTI-930 Addendum No. 5 confirming the halting of B-17 and B-24 conversions into bomber escorts. No more of these aircraft were required, and the B-17s already in the Tulsa Modification Center were to be stripped and released to training centers with the exception of two YB-40s assigned to Materiel Command for testing purposes. The solitary YB-41 was also to be assigned to Materiel Command, being flight-tested from Wright Field. Just 48 hours prior to the issuing of the addendum, the first of two YB-40s from the second batch had been delivered to the USAAF.

The 92nd BG's YB-40s next saw action on July 14 when the Luftwaffe depot at Villacoublay was again attacked. Ten B-17s and five YB-40s were dispatched, and eight of the former bombed successfully and all aircraft returned to base. Three days later, at 0718 hrs, 17 B-17s and two YB-40s departed for Hannover but they were recalled and returned to base. On this mission tactics were revised by placing one or more YB-40s in the lead element.

On July 19, Brig Gen Eaker was informed by Maj Gen Bernard Giles, Assistant Chief of Air Staff, that work on the remaining 12 YB-40s would continue so that they could be sent to Britain as soon as possible, but that no more would subsequently be built.

Five days later, 14 B-17s and one YB-40 were part of a 180-strong force sent to attack the magnesium and aluminum plants at Herøya, in southern Norway. The aircraft effectively neutralized their targets, with 580 bombs exploding within the target area and 151 registering direct hits. The Germans were forced to abandon both plants following the raid. All group aircraft returned to base, with crews rating flak as moderate and the few fighters that attacked as "very aggressive". Twelve B-17s received moderate battle damage, and gunners' claimed four enemy aircraft destroyed in return.

Groundcrew from the 92nd BG wait on a crash tender parked alongside an ambulance as YB-40 42-5734 *SEYMOUR ANGEL* returns to Alconbury following a raid on the Ruhr in June–July 1943. The aircraft's Disney artwork can also be seen just forward of the national insignia. (USAAF)

A mission to Kiel was scheduled on July 25, with the 92nd BG dispatching 17 B-17s and a YB-40. However, only two of the three groups assigned to the operation by the 1st BW were able to assemble, so the mission leader returned to base when it was decided that the force was insufficient in size to defend itself over enemy territory. The following day the 92nd participated in an attack on the Continental tire factory in Hannover, dispatching 17 B-17s and two YB-40s. One of the

latter was forced to turn back early due to an engine problem. Gunners claimed five enemy aircraft destroyed and three probables, although these successes came at a high cost, for three B-17s fell to flak and fighters and seven more were damaged.

The 92nd BG next saw action on July 28 when it was one of nine bomb groups from the 1st BW to participate in an attack on the Fieseler component plant in Kassel, central Germany. The group sortied 14 B-17s (three of which aborted) that were protected by two YB-40s. An estimated 75 to 100 enemy fighters, mostly Fw 190s, pressed home their attacks. On their way from the target, the formation was engulfed by cloud that offered the bombers some protection from the fighters, although two B-17s from the 92nd had by then been lost. Group gunners in return claimed three fighters destroyed and one probable. Battle damage to the surviving Flying Fortresses, while extensive, was considered to be moderate to repair. Four B-17s and one YB-40 landed away from Alconbury.

The following day, two YB-40s and 12 B-17s were dispatched by the 92nd BG on what proved to be the bomber escort's final mission – an attack on the U-boat shipyard at Kiel, on Germany's Baltic Sea coast. During this raid, 50 to 100 Luftwaffe fighters made passes, causing moderate battle damage to three B-17s, while nine more received flak damage. Gunners from the group claimed five fighters destroyed and one probable. All aircraft returned directly to base.

The 12 YB-40s assigned to the 92nd BG had completed a total of just 48 sorties during the bomber escorts' brief time in the ETO. One had been lost to enemy action, and YB-40 gunners had claimed only five German fighters shot down and two probables.

MORE YB-40 MODIFICATIONS

On July 31 Col Marvin Gross issued a final listing of modifications and changes before the YB-40 program was officially cancelled. They were as follows:

Nose:

1. Increase the ammunition supply for the chin turret to 600 rounds per gun and investigate the use of a flexible feed for this turret.

Although of indifferent quality, this photograph of 42-5734 *SEYMOUR ANGEL* reveals the markings that adorned the YB-40s of the 92nd BG from mid-summer 1943. These included the addition of the group's B identifying letter (either in chrome yellow or insignia blue) within a white triangle on the tail and short-lived, red-outlined "star and bars" national insignia on the wings and fuselage. (USAAF)

The ten-man crew of YB-40 42-5737 *DAKOTA DEMON* pose with their aircraft at Alconbury on June 3, 1943, just five days after the bomber escort had made it operational debut with the 92nd BG. The crew was led by Capt George Ott, seen here standing fifth from the right. He had been one of the four pilots sent by the Eighth Air Force to Biggs Field, in El Paso, Texas, to be trained in flying the YB-40. After flying 42-5737 across the Atlantic to Britain, Ott led his crew into action and acted as a flight leader in the training of other pilots within the 327th BS. He was eventually shot down (in B-17F 42-30387) on October 14, 1943 during the Schweinfurt raid, spending the rest of the war as a PoW. (USAAF)

2. Install two hand-held flexible 0.50-cal machine guns on K-5 mounts being fed by 250 rounds per gun.
3. Remove all unnecessary equipment.

Forward Dorsal Sperry Turret Compartment:
1. Replace current Sperry dorsal turret.
2. Increase ammunition supply to 800 rounds per gun.

Rear Dorsal Martin Turret Area:
1. Increase ammunition supply to 800 rounds per gun.
2. Install a "ditching door" to facilitate escape exiting in case of a water landing.
3. Relocate dinghy to radio compartment.

Waist Gun Compartment:
1. Remove waist gun hydraulic power mounts, power unit, guns, armor and deflector plate, ammunition boxes, and track and booster motors.
2. Replace the above with a single hand-held gun supplied by 1,000-round ammunition boxes forward of the windows and with gravity feed and N-8 reflector gunsight.

Ball Turret Area:
1. Modify lower ball turret to incorporate external ammunition feed.
2. Increase oxygen and parachute provisions.

Bomb-bay Area:
1. Remove all bombing equipment and provisions except the necessary equipment to carry bomb-bay fuel tanks, as with the depletion of wingtip fuel tanks bomb-bay tanks are now necessary.
2. Install armor plate for exposed fuel pumps, lines, selector valves, etc.

Tail Gun Compartment:
1. Replace hydraulic power boost mount with standard hand-held mount. Install Eighth Air Force feed or standard B-17 feed. Utilize an N-8 gunsight.
2. Retain large modified tail cone but shorten it to improve the tail gun's field-of-fire.
3. Remove all armor plate except gunner chest plate.

YB-40s already in the frontline were also modified following early mission feedback from 92nd BG crews. Jagdwaffe pilots had long favored simultaneous head-on attacks by multiple interceptors from different directions, and the Bendix chin turret gunner could handle only one fighter at a time. Indeed, he found it very difficult to switch from one rapidly approaching target to another. In an effort to solve this problem, the YB-40s at Alconbury had two hand-held flexible

0.50-cal machine guns installed in mountings on either side of the bombardier's compartment, these weapons covering a cone of fire from approximately 90 degrees to the aircraft's centerline to within 15 or 20 degrees dead ahead. The guns were to be operated by the navigator.

On August 11 CTI-930 Addendum No. 6 cancelled CTI-930 Addendum No. 5 and directed that all YB-40s at Douglas Tulsa were to be modified in accordance with lists received from the Office of Operations, Commitments, and Requirements (OC&R). These modifications were to be accomplished at Patterson Field under the supervision of Capt Richard Pugh using recently delivered YB-40 41-5833 as a prototype. The remaining YB-40 at Wright Field was returned to Douglas Tulsa for modification before 41-5833 was delivered there from Patterson Field.

LONG-RANGE RECONNAISSANCE YB-40

In mid-September 1943 Materiel Command received unconfirmed reports that discontinuation of the second batch of YB-40s at Douglas Tulsa was being considered, with the aircraft being assigned to Training Command instead of the frontline. The OC&R had also received "indications" that work on these YB-40s was to be stopped, stripping them of their weaponry and turning them into trainers. It believed that:

"At this stage of the game it would entail less confusion and less waste of man hours to complete the present airplanes rather than strip them, since moreover the airplanes might be found useful for long-range reconnaissance work in certain other war theaters such as the South Pacific area. It is felt that the proposed disposition of the project will bring it to an end at a time when all the possibilities have not been fully investigated. It is therefore recommended that the airplanes be completed and assigned to other areas for use as long-range reconnaissance airplanes."

On September 21 Materiel Command stated that it did not agree with the suggestion to use the YB-40s as long-range reconnaissance aircraft, and that "bombardment officials had definitely decided that these aircraft should not be completed as YB-40s, but should

Both marked up with new "star and bars" national insignia (which started to appear from mid-August 1943) and more prominent unit codes, 42-5743 *WOOLAROC* and 42-5741 *CHICAGO* fly in close formation for the benefit of the camera. When on operations, YB-40s were initially positioned on opposite sides of the low squadron in the group formation. After several missions were flown in this manner, the bomber escorts were scattered throughout the whole combat wing depending on where the Operations Officer under whose jurisdiction they happened to fall wanted them. (USAAF)

be equipped with standard B-17 waist and tail guns and both dorsal turrets." All armor protection was to be removed and the aircraft were to be used for "training purposes." The YB-40 prototype was to remain as a bomber escort based at Patterson Field, awaiting the arrival of a crew. Once the latter was on-site, the aircraft was to be sent to "Bomber Command for their consideration and comment."

Four days later, Col S. R. Brandshaw issued CTI-930 Addendum No. 7, which was authorized by the USAAF's Commanding General, Gen Henry H. "Hap" Arnold. This directive officially, and immediately, terminated all Tulsa YB-40 modifications. All aircraft were to be "restored" to standard bomber configuration so that they could be transferred to flying training gunnery schools in the US. All turrets were to be installed and the waist and tail guns retained. All special armor was to be stripped out and the standard B-17F armor previously removed was not to be reinstalled.

YB-40 CONCLUSIONS AND TEST RECOMMENDATIONS

During October, Materiel Command's Engineering Division estimated the total cost of the XB-40 project at approximately $569,000, with the first 13 aircraft costing $470,000. The Engineering Division affirmed, "It was highly questionable whether it was desirable to design an airplane which, possessing no performance superiority, will fly in formation with bombardment airplanes in an effort to augment their already considerable massed firepower, and which will be exposed to the same hazards over hostile territory, and which will have no bomb load to deliver. The true escort was conceived as nothing more or less than a long-range fighter."

The Engineering Division recommended that in any future heavy bombardment aircraft development, "more consideration and weight should be given to designs that provided a certain degree of flexibility between defensive armament load, bomb load, and fuel load. Thus, it might be possible to increase or decrease the firepower of the bomber as the tactical situation demanded."

On October 16, the Engineering Division issued *A Memorandum Report, Appendix No. 4: General Discussions of Project and Escort Theory*. It was divided into three sections – Escort Theory, Future Development, and Armament. Regarding Escort Theory, the report stated, "Under conditions existing in the Eighth Air Force during the service test period of June and July 1943, the idea of interspersing in bombardment formations large numbers of non-bomb-carrying escorts of converted B-17 type did not appear to be feasible or economical. It is seemingly more reasonable to absorb those improved features of the YB-40 armament which were particularly needed at the time into the armament of the bombardment airplane."

The report rigorously questioned the economic soundness of a bomber escort aircraft that had no performance superiority, barely augmented the already considerable firepower of standard bombers, was more exposed to enemy interceptors, and could not deliver a bomb load over a target. It drew attention to the Jagdwaffe's

penchant for frontal attacks on USAAF bomber formations, and noted that "for this reason the only YB-40 armament installation acquiring any similar degree of popularity was the chin turret, which provided extremely effective protection against this type of attack." The report noted that the other YB-40 gun installations were mainly designed to deal with rearward attacks and "were not well thought of because at the time they were not being used sufficiently to pay for their passage as far as weight and adverse effect center-of-gravity were concerned."

Under the heading Future Development of the Bomber Escort, the report concluded that senior personnel in the USAAF were "having considerable doubt as to whether the advance in defensive armament equipment of presently envisioned heavier bombardment planes is such as to operate successfully without fighter escort. It is felt, therefore, that the problem of providing adequate fighter protection should be solved as quickly as possible."

The report went on to state that any future attempt at developing a bomber escort should consider "flexibility" between the aircraft's defensive armament load, fuel load, and bomb load. This essentially meant that the bomber escort had to possess the ability to increase or decrease the firepower it could deliver into any particular sector by changing the number, or caliber, of guns, type of mount or turret, the quantity of ammunition carried, and the number of independent gun positions providing protection against simultaneous attacks in that area. The level of armor plate protection offered to the crew would also vary depending on the mission. These considerations would then dictate the aircraft's bomb and fuel load limitations.

The report's observations on the state of defensive armament specified that the power-operated mounting was superior to hand-held guns in delivering more effective fire at longer ranges, as it was very difficult for gunners to manually fire twin or even single 0.50-cal guns in train for more than a few shots. An effective burst of fire was generally considered to be 25 to 50 rounds, which could only be accomplished with rigidly-mounted guns that decreased dispersion and yielded an adequate concentration of fire.

42-5736 *TAMPA TORNADO* served with three bomb groups while in the ETO, although it only saw combat with the 92nd BG. By the time it was photographed at Kimbolton, in Cambridgeshire, on October 2, 1943 during a base open day for local families, the aircraft was assigned to the 524th BS/379th BG as a crew trainer. Flown back to the US on March 28, 1944, the YB-40 served with the 3010th BU at Williams Field, Arizona, before being sent to the RFC for reclamation at Ontario, California, on May 18, 1945. (USAAF)

The ammunition feed mechanism of the YB-40's power-operated guns came in for criticism, the report noting it had caused "considerable difficulty in the field." It was suggested that "every possible effort be made to rely on gravity feed so as to reduce the level of reliance on unreliable booster motors." The continuing development of "light power" mounts for the B-17 tail position and the waist positions for both the B-17 and B-24 was of "considerable importance."

"Every effort" was to be made to have all the ammunition required at each gun position in continuously belted form, as reloading in combat had not only been impractical but hazardous, for the majority of rounds were expended during intense combat when there was little time to belt up loose bullets.

To dissuade head-on attacks, it was imperative for gunners to be able to fire accurately at ranges up to 700 yards or more, for tracking speeds increased as the two opposing aircraft closed on each other. The use of a power mount or turret was strongly advised in the nose.

The report also stated it was unfortunate that the Allison-powered XB-40 was not developed.

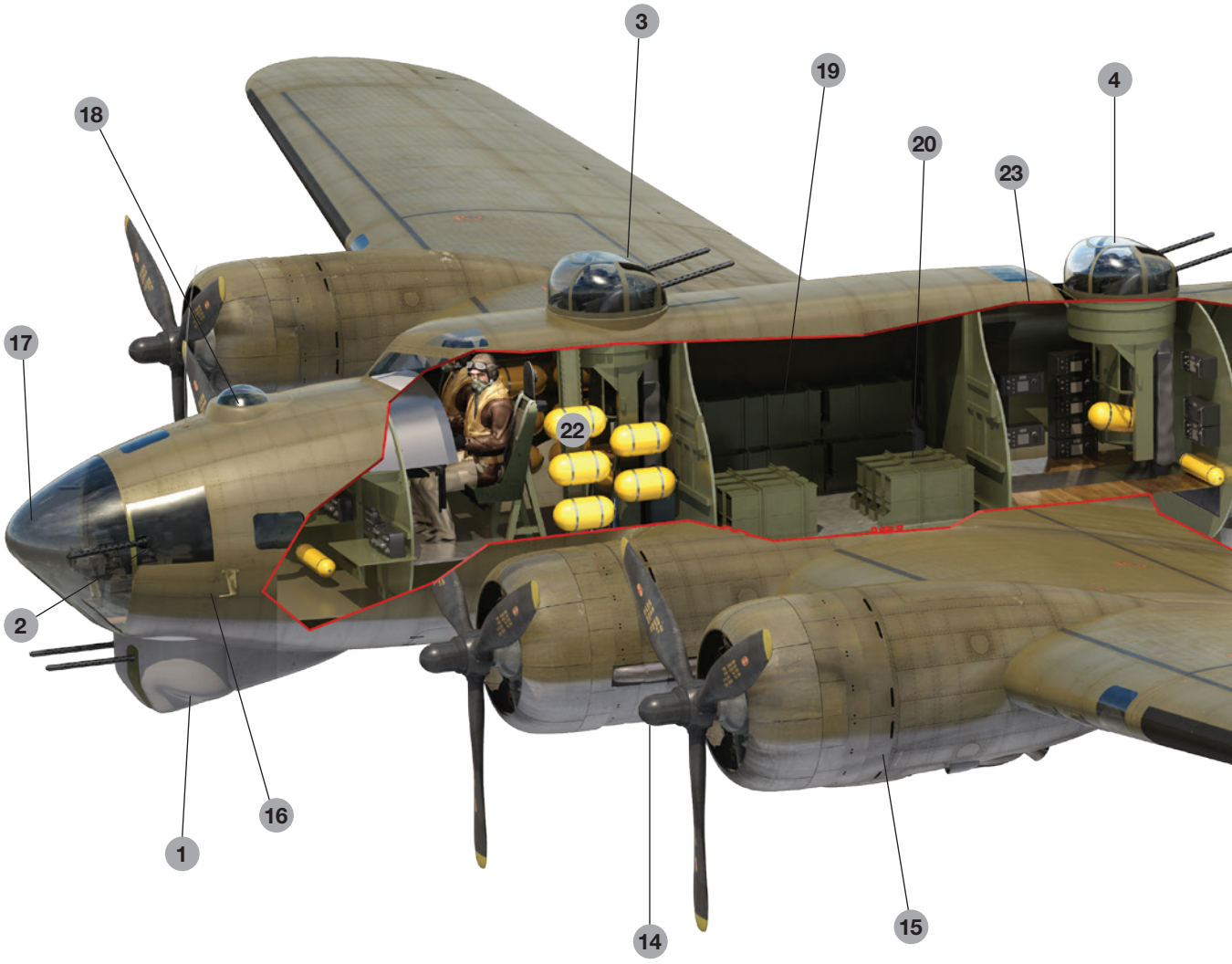
The Engineering Division felt that the amount and kind of enemy fighter resistance in any combat theater at that time was "too variable to ever be accurately predicted" in the development of any future bomber escort. The "complete protection" of individual bombers flying in close formation from "every conceivable" aerial threat was also considered as "neither economical or even possible" if that bomber was to carry even a token bomb load. It was considered "desirable" to develop an "aerial strongpoint" by equipping different units within a formation with varying types of armament that provided the "best all-around defense at the least cost in weight." Armament load would, therefore, need to be flexible in any future bomber escort or individual bomber development.

The report surmised that it was "quite probable" during the progression of a successful bombing campaign that enemy fighter opposition would increase, hammering bomber formations until an ultimate peak was reached, after which fighter opposition would decrease until the enemy was defeated.

It also stated that it "was impractical to achieve added protection for the bombardment formation by converting a certain percentage of standard bombers to heavily-armed non-bomb-carrying escorts." The complete protection of individual bombers operating in close formation from every conceivable angle of attack was neither economical or even possible if more than a token bombload was to be carried at the same time.

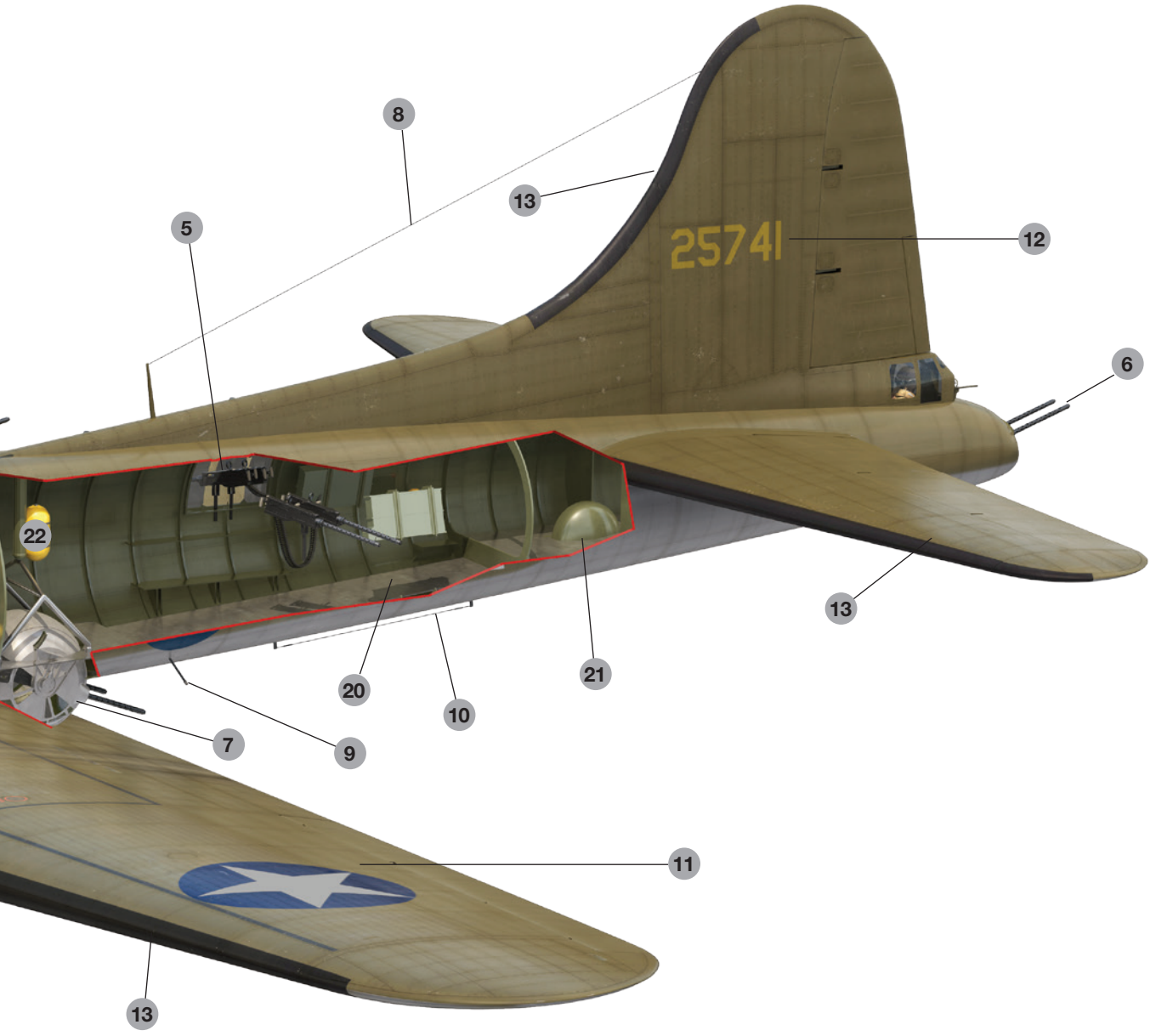
The report also noted that it was "conceivable that after the mastery of the air over hostile territory has been achieved, bombers with little or no defensive armament against fighters could be employed, though it is not probable that such a condition would endure very long before the enemy would be forced into defeat."

It believed that a more integrated and logical development of the bomber escort would have been possible if the administration and



KEY

1. Bendix chin turret (twin 0.50-cals/400 rounds per gun)
2. Cheek gun (single 0.50-cal/300 rounds per gun)
3. Briggs Sperry forward dorsal turret (twin 0.50-cals /400 rounds per gun)
4. Martin 250 CE4 rear dorsal turret (twin 0.50-cals /600 rounds per gun)
5. USMC waist guns, twin mounts on each side (twin 0.50-cals/300 rounds per gun)
6. USMC tail guns (twin 0.50-cals/750 rounds per gun)
7. Briggs Sperry A-2 ball turret (twin 0.50-cals/600 rounds per gun)
8. Command set high-frequency antenna cable
9. Trailing antenna
10. Ventral marker beacon antenna cable
11. National insignia specification No. 24102-K
12. Aircraft partial serial number



13. De-icer boots (wings and empennage)
14. Hamilton Standard three-blade, hydromatic, constant-speed propeller
15. Wright R-1820-97 1,380hp radial engine
16. Pitot static tube
17. One-piece Plexiglas nose fairing
18. Astrodome
19. Bomb-bay (reconfigured to contain extra ammunition boxes)
20. Ammunition boxes (250 rounds per box)
21. Tailwheel housing
22. Yellow oxygen cylinders
23. Radio equipment

control of the service test aircraft had remained with the Engineering Division. An improved YB-40 could have been delivered in less time if Vega had been permitted to assume the conversion of the service test escorts within its Burbank factory.

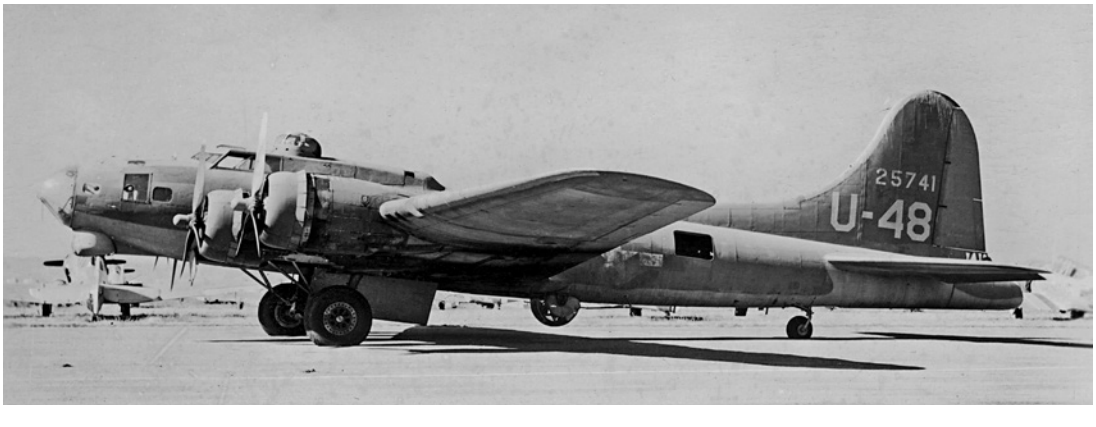
The report stated that the YB-40's armament installations were generally satisfactory, with the exception of the feeding arrangement for the waist and tail gun power units. As has previously been highlighted, the service test report confirmed that the added armament installations in the YB-40 moved the center-of-gravity too close to its aft limitation, resulting in insufficient rearward space for modifications and loading.

An "added degree of versatility" was desired in bombers so that modification centers or Air Service Command facilities in the field could more readily adapt their bombers "to cope with the tactical problems of the day."

Finally, the report recommended that whenever a new type of bomber was scheduled for production the USAAF should adopt a general policy whereby a limited number of airframes were set aside for the experimental development of new and improved armament installations. It also urged the development of a long-range, multi-turreted fighter or true escort for the B-29 Superfortress and B-32 Dominator heavy bombers then in the early stages of flight testing. Possible range extension for such a bomber escort also needed investigation so that new bombardment aircraft – namely the B-35 flying wing and B-36 Peacemaker – could be accompanied throughout their normal mission range.

42-5833 IN THE ETO

Although all YB-40s sent to the ETO had been removed from operations in late July 1943, 42-5833 from the second batch of B-17Fs to be converted was sent to the 92nd BG in October 1943 for non-combat evaluation. As previously noted, this aircraft embodied many of the changes requested by VIII Bomber Command to improve the YB-40's handling and fighting qualities. Its engines had improved armor protection, but plating in the rear of the aircraft had been reduced in order to rectify the YB-40's center-of-gravity



YB-40 42-5741 returned to the US from the ETO on November 2, 1943 following brief service with the 92nd BG, and it subsequently served with the 3036th BU at Yuma, Arizona, from May 4, 1944. Stripped of its armament and with a flat tailwheel, the aircraft appears ready for reclamation by the RFC at Ontario – it was turned into aluminum ingots on May 8, 1945. (Gordon S. Williams/Frederick A. Johnsen Collection)

issues. Further reductions had brought about an improvement in the aircraft's empty weight, although the YB-40 was still substantially heavier than the B-17G – the first examples of which had reached the ETO the previous month.

The most significant change seen on 42-5833 was the fitting of an entirely new Cheyenne tail gun position in which the two 0.50-cal weapons, although still hand-held, were located closer to the gunner and held in a cupola that moved in azimuth. The tail position now also boasted an N-8 reflector gunsight. This new arrangement was both easier to handle and provided a wider cone of fire.

Although 42-5833 was not used operationally by the 92nd BG, and it was eventually flown back to the US, VIII Bomber Command reported favorably on the Cheyenne tail gun position. As a result of this, a fabricated kit was created for its installation into B-17Gs at the Cheyenne Modification Center, while others were sent to Britain and Italy for fitment to aircraft already in-theater. The "Cheyenne turret", as the position was eventually dubbed, was introduced on production B-17Gs from the summer of 1944.

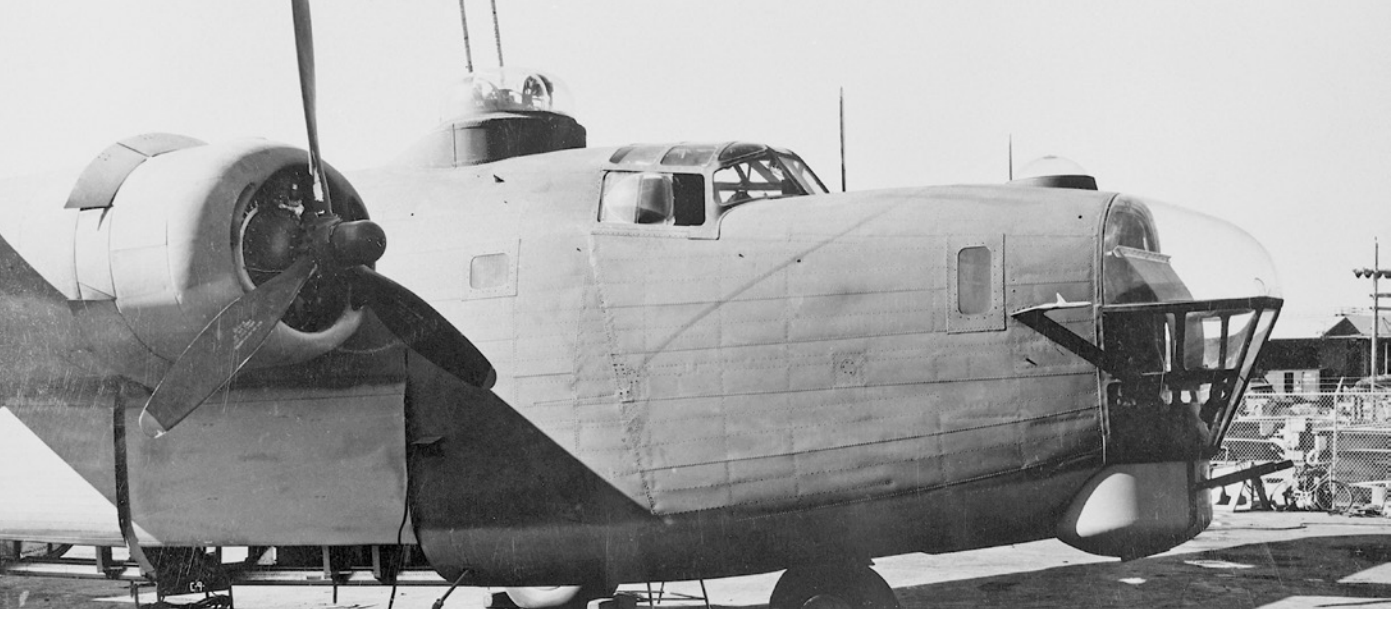
YB-40 POSTSCRIPT

As Executive Director of the Military Requirements Division, Col Marvin Gross had previously ordered that two YB-40s be built per month for six months beginning in March 1943. These additional aircraft were to be replacements for the original 13 bomber escorts converted by Douglas Tulsa. However, following the Eighth Air Force's disapproval of the YB-40 project, there was uncertainty as to the continuation of the program. It was ultimately cancelled, and then reinstated until September 1943, when CTI-930 Addendum No. 7 directed the cessation of work on the YB-40s at Douglas Tulsa and their assignment to Training Command.

Upon discovering that the YB-40s were to be withdrawn from service in the ETO, Col T. J. DuBose, Chief of Aircrew Training within Training Command, asked Brig Gen Ira Eaker to transfer the aircraft to flexible training schools in the US. Dubose argued that the YB-40s would be valuable for this purpose because they were fitted with armament not present in the B-17E/Fs his squadrons were equipped with – specifically the Bendix chin turret. However, Brig Gen C. C. Chauncey of Eighth Air Force HQ requested that VIII Bomber Command retain the YB-40s in Britain for use in short-range missions. He also stated that he could use their "special armament."

Ultimately, Col DuBose's argument proved to be the most persuasive, for most of the surviving aircraft were returned to the US during November 1943 and used as training aircraft. This also meant that for each YB-40 issued to Training Command, a standard B-17F/G could be freed for operational service.

Most YB-40s were sent for "reprocessing" in 1945, with the majority of them going to the RFC's vast Ontario, California, facility in May of that year. Here, they were cut up and smeltered into aluminum ingots. No airframes were sold on the civilian market.



CHAPTER THREE

XB-41 BOMBER ESCORTER

This view of XB-41 41-11822 shows its forward Martin 250 CE4 dorsal turret, Bendix chin turret, and inboard Pratt & Whitney R-1830-43 radial engine fitted with a wide-blade propeller. The forward Martin turret could be raised approximately 13 inches in order to obtain straight aft fire over the rear dorsal Martin turret, and then lowered to decrease aerodynamic drag when not in use. (USAAF/Frederick A. Johnsen Collection)

As detailed in Chapter One, after design studies for a bomber escort type aircraft were initiated in June 1941, three months later, on September 17, Lt Col. F. O. Carroll, Chief of the Experimental Engineering Section, submitted a request to the USAAF Materiel Division for the issuance of a directive for the development of a convoy protector for medium and heavy bomber aircraft.

The April 1, 1942 Experimental Engineering Section Conference presided over by Brig Gen Muir Fairchild, Director of Military Requirements, discussed the military characteristics of the escort bombardment aircraft and decided that the development of an "entirely new airplane would be too time consuming." The "consensus of opinion" was that a B-17F and B-24D be modified for this purpose. During the conference the serious deficiency in forward armament fitted to USAAF bombers in light of the Jagdwaffe's preference for head-on attacks was discussed at length.

The CTI-571 report, dated April 9, 1942, by Col Marvin Gross, Executive Director of Military Requirements, recognized the need for the bombardment escorter and presented a detailed outline as to its basic characteristics. It also urged that "immediate action" be taken to meet these requirements.

On August 21, 1942, Maj Gen Carl Spaatz, Commanding General of the Eighth Air Force, stated that what he termed "the destroyer escort plane project" had his "complete approval," but the aircraft needed to be ready within six months to be effective in its role. The XB-40 and XB-41 bomber escorters had to be designed in such a way that they could be modified on the regular production line, for if successful

San Diego-built B-24D 41-11822 was selected to serve as the XB-41 prototype as it had already been fitted with some of the equipment deemed necessary for the bomber escort conversion. Following the completion of flight testing as an XB-41, 41-11822 was stripped of its armament and converted into a TB-24D for Training Command. The aircraft then served as an instructional airframe for would-be Liberator mechanics. It was scrapped at Maxwell Field, Alabama, on February 2, 1945. (USAAF)

they would be required in large numbers. Ten days later, Brig Gen A. J. Lyon, USAAF Headquarters, ETO, submitted Technical Report 239 which specified the "must have" general and detailed requirements for a destroyer aircraft – these are detailed in Chapter Two.

Brig Gen Fairchild expressed his interest in an escort conversion of a B-24 on September 23 as long as the aircraft followed the requirements outlined for the XB-40 in the CTI-571 report from April 9. Six days later, the Office of the Director of Military Requirements issued CTI-930, directing the conversion of the B-24 into a "Bombardment Escort Airplane" – this covered the "quick conversion" of six B-17s and six B-24s for use as soon as possible. A B-24D assigned to the AAFPGC at Eglin Field was to be returned to Consolidated's San Diego factory for conversion.

On October 16, now Col F. O. Carroll stated that the conversion of the first B-24D was to be managed by the Experimental Engineering Section, and it would be similar to the work undertaken to turn B-17F-1 41-24341 into the prototype XB-40. As time was limited, Col Carroll also requested that the Motor Products Corporation of Detroit immediately send an example of its A-6A tail turret to Eglin Field for expedited testing in readiness for fitment to the Liberator conversion.

On October 20 experimental installations of the Bendix nose turret were completed on both the B-17F and B-24D at Eglin Field. Although these turrets were similar in design, they differed in arrangement of the gunsight. The B-24D had a column rotated in azimuth by the turret, while the sight in the B-17F was driven both in azimuth and elevation by flexible shafts. The latter installation was soon shown to be superior.

On October 25, Col Carroll requested that the classification XB-41 be assigned to bombardment escort aircraft conversion of the B-24D. This was approved three days later, as was the project number MX-320. October 25 also saw the return of B-24D 41-11822 to Consolidated for conversion into the XB-41 at the company's expense. Modifications and alterations were to include:

1. Installation of a GFE Martin 250 CE4 turret above the aft bomb-bay.
2. Installation of a GFE Briggs Sperry ball turret employing a retraction mechanism.
3. Installation of two GFE USMC twin 0.50-cal Type M-5 side gun mounts.

4. Raising the Martin 250 CE4 in the upper forward position approximately 13 inches in order to obtain straight aft fire over the dorsal rear Martin turret.
5. Increase ammunition supply provisions.
6. Install additional armor plating.

After the completion of this work, Consolidated was to conduct flight tests to determine:

1. Pilot's preliminary observations.
2. Calibration of the airspeed motor.
3. Determine the aircraft's top speed at its optimum operational altitude.
4. Cruising speed.
5. "Saw tooth climb" at one altitude.
6. Check climbs.
7. Operational testing of armament.
8. Pilot's final observations.

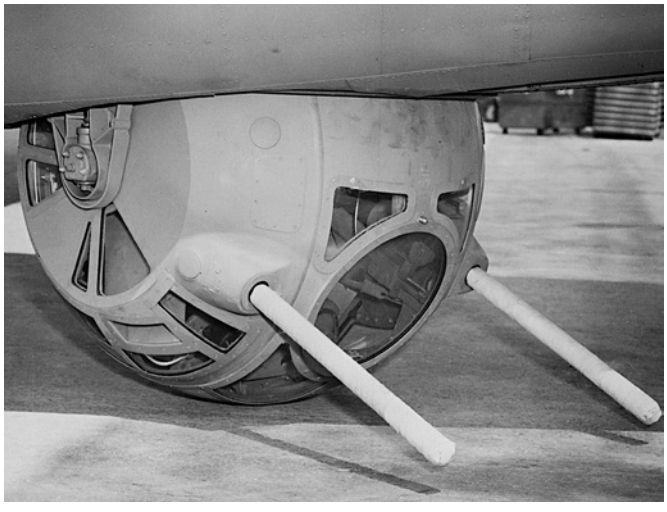
Consolidated was to supply the USAAF with:

1. Working drawings of conversions (in triplicate).
2. Technical Report concerning the necessary steps in effecting the conversions (in triplicate).
3. XB-41 supplements to the *Pilot's Handbook* and *Service Manual* (five copies).
4. A complete set of stress analysis and weight data.

Consolidated was to furnish the necessary "skilled" pilot and engineering personnel to conduct the required flight tests, as well as the necessary personnel to maintain the aircraft "in serviceable condition." After all contracted conversions and tests were completed, Consolidated was to return the XB-41 "completely" setup, serviced, and ready for flight at an "approved" site near to San Diego airfield for final inspection. All fuel, oil, and cooling fluids were to be supplied by Consolidated.

On January 6, 1943 Consolidated reported that the XB-41 conversion was nearly completed, and delivery would take place approximately six days later. Consolidated submitted a $26,500 quotation for its work. On the 8th J. W. Schwinn, Chief of the Aircraft Products Branch, recommended that a fixed price contract be initiated to cover the conversion of the B-24D into the XB-41. By then 41-11822 had been fitted with a B-24D chin turret, A-6A tail turret, and GFE.

On January 12 Maj Gen Davenport Johnson, Director of Military Requirements, requested that Materiel Command at Wright Field modify 13 B-24Ds into YB-41s for delivery to Britain for service testing. At that time the XB-41 was incomplete, and the YB-40s were delayed due to problems in obtaining weaponry. Johnson, therefore, requested that every "effort be made to expedite the XB-41 project." Two days later, the Experimental Engineering Section's Col Carroll protested the procurement of just 13 YB-41s, emphasizing that



The Briggs Sperry-built A-13 retractable ball turret was a 44-inch spherical metal structure that could be extended about 24 inches below the skin line of the aircraft. It was designed especially for the B-24, whose low ground clearance required that the ball turret be retracted during takeoffs and landings. The A-2 and A-13 turrets were exactly the same except for the latter's retracting mechanism, which was very simple. Seldom extended while on the ground, this is the lower ball turret of a standard B-24 Liberator bomber. The gun barrels have been wrapped, possibly for flyaway delivery from the factory. (Convair/Frederick A. Johnsen Collection)

contracts for such a limited number of aircraft would delay regular production, and that orders should be placed for 100 YB-41s or "none at all." To make the possible reconversion of YB-41s back to standard B-24s as simple a process as possible, ammunition and fuel loads were to be reduced so that bombs could also be carried.

Despite Carroll's disapproval, on January 15 CTI-930 Addenda No. 2 changed CTI-930's original requirement for six XB-41 conversions to 14 – one XB-41 and 13 YB-41s. Two days later, a Fixed Price Supply Contract (ac-36959) for $26,500 as request by Consolidated on January 6 to cover the XB-41 conversion was granted. It provided the company with funds for "the performance of services necessary to convert a B-24D into a bombardment escort plane." The contract also confirmed that additional guns to be furnished as GFE were a dorsal Martin 250 CE4 turret installed aft of the bomb-bay, a Briggs Sperry ball turret, a pair of twin 0.50-cal USMC power-boosted Type M-5 side gun mounts, and a dorsal Martin 250 CE4 turret aft of the cockpit.

On January 22 the XB-41 gained an 11th crewman in the form of an ammunition stocker, and his oxygen and interphone equipment was added to the conversion requirements. Four days later, the Progress Report issued by Capt Charles Hawks, Chief of the Experimental Engineering Section, Western District (Los Angeles), described the status of the XB-41 after the completion of its first eight flight tests. It stated that all firing tests had been satisfactorily completed, and four hours of flight performance testing qualified the XB-41 to be given to the delivery crew for their flight to Eglin Field on or about January 26.

On February 4, Brig Gen Benjamin Chidlaw, Assistant Chief of the Air Staff, Materiel Division, chaired a conference attended by Brig Gen Oliver Echols, Chief of Materiel Command, Brig Gen Eugene Eubank, Director of Bombardment, and Col Donald Putt, Chief of the Production Engineering Section. The attendees decided that the procurement of 100 YB-41s was not to be initiated at this time, and the 13 aircraft that had been ordered were to be delayed pending the results of the Eglin Field tests.

The Consolidated A-6 tail turret contained twin 0.50-cal machine guns mounted on a USMC Type M-5 gun mount. These turrets were confining, drafty, cold, and generally very uncomfortable, and they also had poor visibility. Worse still, the turret was very heavy, causing center of gravity problems that would plague the B-24 throughout its career. (USAAF)

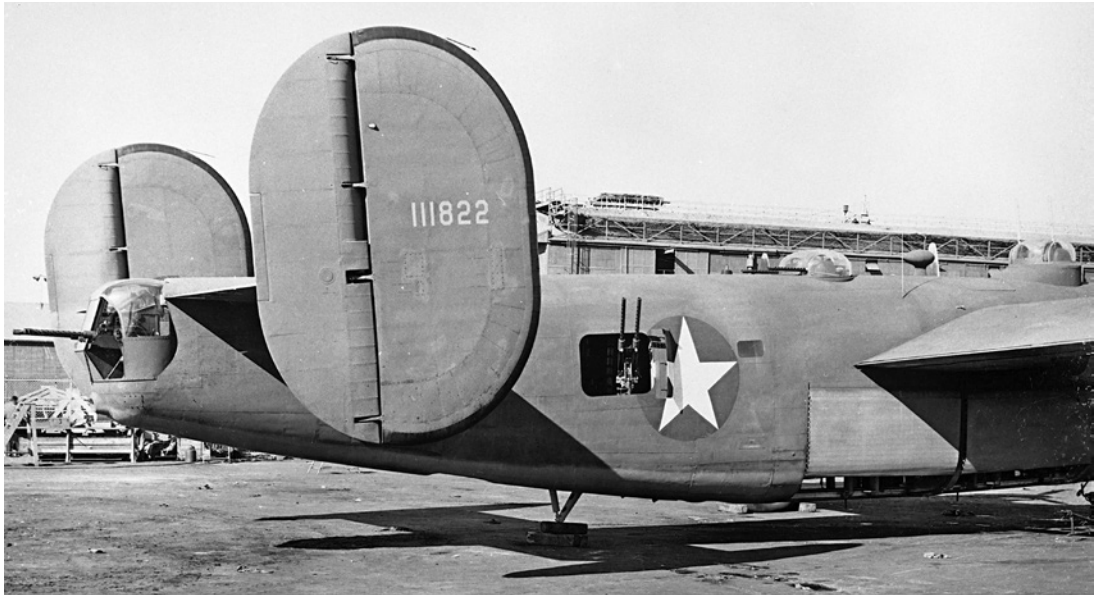
After a conference on February 13, Col B. L. Boatner, Chief of all USAAF Aircraft Modification Centers, announced that the XB-41 would be flown to the Lockheed Modification Center in Dallas, Texas, where parts would be procured from Consolidated to allow 13

YB-41s to be converted, using 41-11822 as a prototype. When the XB-41 arrived at Eglin 11 days later, additional modifications were required before approval could be granted for it to serve as the YB-41 prototype. Work on the YB-41s would be delayed for some time pending clarification of the technical details.

Brig Gen Grandison Gardner, Commanding General of the AAFPGC at Eglin Field, notified Materiel Command at Wright Field on February 26 that the XB-41 tests had disclosed low climb and ceiling characteristics and an unsatisfactory center-of-gravity that was too far aft, although the "extensive" armament installations were satisfactory. The AAFPGC recommended the suspension of development until the latest B-24D production model became available, as it incorporated most of the elements required in the YB-41.

The Wright Field Engineering Division directed that the XB-41 be returned to San Diego for modifications, including the installation of wide-blade propellers and a new B-17-type chin turret, removal of side gun transverse armor plating, reworking of the dorsal forward turret, and repair of the tail turret. These modifications were authorized at a cost of $50,456, in addition to the original contract value of $26,500.

CONSOLIDATED XB-41 41-11822, EGLIN FIELD, FLORIDA, FEBRUARY 1943



XB-41 rear view showing the two Martin dorsal 250 CE4 turrets, the waist USMC power-operated twin 0.50-cals, and the USMC tail turret. The XB-41 carried 12,420 rounds of ammunition, 4,000 rounds of which were stored in the bomb-bay as a reserve. The additional weight of armor, guns, and ammunition brought the gross weight up to 63,000lbs, making the XB-41 6,000lbs heavier than a standard B-24D. (USAAF/ Frederick A. Johnsen Collection)

On March 2, now Col H. Z. Bogert, Chief of the Technical Staff at Wright Field, informed Col F. O. Carroll of the XB-41's continuing center-of-gravity problems as determined by the Aeronautics Laboratory Weight Unit, and the consideration now being given to the improvement of defensive armament in standard B-24 bombers. The decision was made to suspend further evaluation of the XB-41 as a production prototype. However, upon rechecking its results, the Weight Unit at Wright Field determined that there was an error in calculating the location of the XB-41's center-of-gravity. By redistributing the ammunition load and removing the armor plate at the waist gun positions, the center-of-gravity could be improved to acceptable levels. Col Bogert then recommended that these changes be made, after which the XB-41 should then be sent for service testing alongside the XB-40.

The following day, Consolidated informed Col Carroll that it had intended to make necessary corrections by replacing the Bendix nose turret with the Emerson turret if a B-41 production order was granted. The company's proposed Emerson nose turret installation would not have immediately solved the XB-41's center-of-gravity problem. Indeed, on March 6, the Wright Field Engineering Division stated that it did not want to replace the Bendix chin turret with the Emerson unit. Instead, it pursued other methods in order to rectify the problem, such as reduction of waist gun armor and movement of reserve ammunition and oxygen bottles further forward. Bogert ordered the XB-41 to be immediately returned to Consolidated in San Diego for center-of-gravity improvement, after which it was to be flown directly flown to Eglin Field for further examination and testing.

On March 14 Col Gross again requested that the XB-41 program be cancelled, citing unfavorable findings by the AAFPGC. Nevertheless, further testing was intended to correct the center-of-gravity problem

and increase performance to the latest operational standards required by VIII Bomber Command for possible use in the ETO. Three days later, Brig Gen Bernard Chidlaw issued CTI-930, Addenda No. 3, initiating the cancellation of 13 YB-41s.

The *Final Report on Test of the Tactical Suitability of the XB-41* at Eglin Field was issued by the AAFPGC on March 19, the standard B-24 and the XB-41 having flown comparison trials in speed, rate of climb, and general flying characteristics. The XB-41 was found to be "unfit for combat services as an escort fighter" for the following reasons:

1. The XB-41 was 15mph slower than the standard B-24 bomber.
2. It could not climb with the B-24.
3. It had a service ceiling of approximately 22,000ft.
4. The heavy XB-41 used more power to climb and fly in level formation with the B-24, resulting in excessive fuel consumption.
5. It was unstable when loaded for combat.

Consequently, the AAFPGC recommended that further XB-41 development be suspended until the prototype of the latest B-24D, with the most current armament, be completed. Provisions were to be made in all B-24Ds for the installation of a dorsal rear turret so that a Liberator could be converted into a YB-41 if needed.

On March 23 Col H. Z. Bogert, while granting the YB-41 the highest priority among experimental projects, requested that Consolidated only use its facilities to modify the B-24D as long as it did not interfere with the company's regular Liberator production. While in San Diego, the XB-41 was to be fitted with a production-type Bendix chin turret as used by the YB-40, the center-of-gravity was to be improved and the rear horizontal stabilizer strengthened – the latter modification was now being introduced to B-24Ds progressing along the production line. While this reinforcement placed the center-of-gravity back into the stable range for high-speed flight, the XB-41 remained unstable at low cruising speeds and during its landing approach. Furthermore, while on the ground, the aircraft was unbalanced for handling and would settle on its tail skid.

The nose armament of later-build B-24Ds included cheek-mounted 0.50-cals to port and starboard, and a third Browning machine gun of this caliber protruding through the upper front section of the clear Plexiglas nose. A fourth 0.50-cal was sometimes installed as a field modification to fire through the bottom of the nose. (National Archives)

On April 3, once studies had been completed on the XB-41's weight, the Engineering Division decided that the aircraft's ongoing center-of-gravity problems could be corrected with "a minimum of effort." Because of the initial interest in a Liberator escort, and the AAFPGC's recommendation for the installation of improved armament in the B-24D, the Engineering Division resubmitted the XB-41 for further testing after Consolidated had corrected its shortcomings. The "fixes" included fitting a B-17F chin turret, wide-blade propellers, production-type armor plating to Station 2.0, removal

of the side gun transverse armor plating, and strengthening of the horizontal stabilizer. This work was undertaken at the Sacramento Air Depot.

Capt Charles Hawks of the Experimental Engineering Section, Western District, notified Col F. O. Carroll of the status of changes made to the XB-41 on April 28. A number of the listed changes to be made were not incorporated on the XB-41, however, as the specifications were for late-build B-24Ds. Since the XB-41 had previously been provisionally accepted by the AAFPGC, Hawks wanted to know if it would be provisionally accepted again, or if it was to remain at Consolidated for the installation of later B-24D items.

Two days later, the company was notified that the aircraft would be accepted without the 31 master changes to be specified by a Change Order that was still being prepared. Consolidated responded that it would be necessary to negotiate the required additional rework – at a cost of $50,456 – not covered in the contract (ac-36959). Since Materiel Command was eager to prove the worth of the XB-41 as soon as possible, it did not consider it necessary to delay the project for the addition of items not essential for the role of escort.

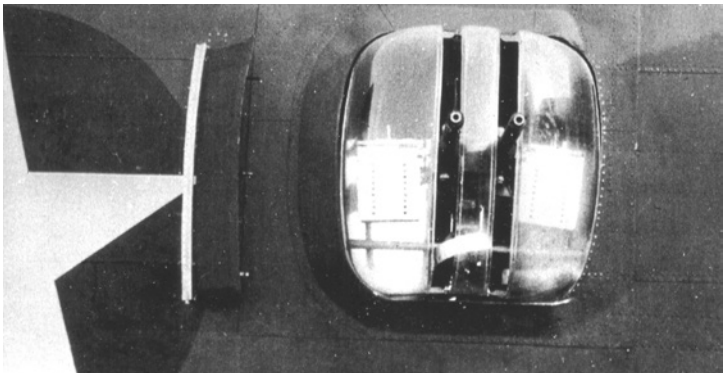
Change Order ac-36959 No. 1 was to expedite the delivery of the aircraft, the alterations to which now only included:

1. Installation of the Bendix chin turret.
2. Installation of the wide-blade propellers.
3. Removal of side transverse armor plating and supports.
4. Rework forward dorsal turret.
5. Rework tail turret.
6. "Miscellaneous."
7. Two to three hours of flight testing.

In correspondence dated May 1, 1943, Materiel Command questioned Consolidated's $80,807 cost, which had far exceeded the company's original estimates of $26,500, for implementing the original contracted conversions. Consolidated defended the cost overrun by stating it "believed that the Materiel Center [Command] can appreciate the difficulties involved in estimating this type of work due to its highly experimental nature, and it is possible that it will be sympathetic toward the quotation for the rework. It is possible that some juggling of the figures will be necessary. However, [the Command] should know the actual facts in the matter, and if you can work out a deal to help us in the recovery of some of our extra costs, it certainly would be appreciated. In any event do the best you can."

The Experimental Engineering Section was so anxious to obtain the XB-41 for immediate testing that on May 6 Col Donald Putt contacted Consolidated directly requesting the XB-41's delivery, less uncompleted conversion items except the stowage provisions for the 800 rounds of ammunition in the nose.

The fitting of the Bendix chin turret in the XB-40 proved easier than in the XB-41, with considerable fabrication work required on the heavily glazed nose of the latter aircraft. The XB-40's chin turret had a 180-degree azimuth field-of-fire, while the turret on the XB-41 was restricted to less than 150 degrees. (USAAF)



Each staggered waist gun position in the XB-41 had twin 0.50-cal machine guns fitted to USMC hydraulic power-boosted Type M-5 gun mounts. The weapons were bolted to an adapter that was in turn attached to a fork seated in a mounting post. Recoil absorption was provided by an Edgewater steel adapter. The Plexiglas blister seen here was later removed as it was found to distort the gunner's view. The vertical wind deflector is located at the right tip of the white star. (USAAF)

As noted in the previous chapter, on June 6 Brig Gen Oliver Echols chaired a conference at which it was decided that no additional XB/YB-41s were to be produced, and the one already modified should be assigned for further testing. Also, no additional YB-40s would be required.

On July 28 the modified XB-41 returned to Eglin Field, and eight days later Materiel Command reported on the results of the operational suitability and armament tests undertaken by the AAFPGC. The preliminary tests indicated a "satisfactory" location for the center-of-gravity and "no adverse flight characteristics." Comparative performance tests conducted with a standard B-17F suggested that it would be feasible for a YB-41 escort to accompany the Boeing bomber. However, it suggested that the following changes should be made before service testing or production commenced:

1. Install two flexible 0.50-cal machine guns in the nose, even when a chin turret was used, or replace the chin turret with a two-gun nose turret.
2. Increase the ammunition capacity of all gun stations to 600 rounds per gun for use without reloading.
3. Remove ammunition boxes from the ball turret.
4. Remove USMC twin side guns and replace them with hand-held mounts, each with a N-8 gunsight.

Because other armament had not been significantly changed, the only weapons to be tested were the chin turret and side guns. The Experimental Engineering Section requested that the AAFPGC conduct further tests comparing the performance of the B-17F with the XB-41, which was to be loaded to simulate combat conditions. These two aircraft were to fly in formation, testing high-speed military power, rated power, cruising power, and also engine-rated power climbs. On August 5, Materiel Command informed Gen "Hap" Arnold of these results.

For the August 18 AAFPGC tests, the XB-41, loaded to 58,600lbs, was flown on the wing of a B-17F loaded to 58,000lbs. At sea level the XB-41 had little difficulty staying in formation with the B-17F at all power settings. When violent evasive action was initiated, the XB-41

NEXT PAGES

XB-41 FLIGHT TEST

Although the sole XB-41 never flew in combat, the bomber escort was put through its paces during a rigorous flight test program undertaken by the AAFPGC from Eglin Field in early 1943. This evaluation, requested by Materiel Command, confirmed that the XB-41 was not operationally suitable for use as a bomber escort, and its development was immediately discontinued. The aircraft was routinely accompanied by P-39 chase planes from the AAFFPGC during its test flights out over the Gulf of Mexico.

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was able to maneuver with the B-17F with "considerable effort." A climb in formation to 10,000ft was commenced, with the B-17F climbing at 155mph and 400ft per minute. The XB-41, however, did not have sufficient rate of climb to remain with the B-17F. Once at 10,000ft the XB-41 was again able to remain in formation at all power settings, but it was unable to maneuver with the B-17F as it did not have rapid enough acceleration when the power settings were increased. Furthermore, it could not decelerate fast enough, causing it to overrun the B-17F. The two aircraft were then flown in formation at 21,000ft, with the same difficulties occurring before the B-17F encountered engine problems that terminated its participation in the test.

The XB-41 continued to climb to its service ceiling of 29,000ft. At all altitudes above 26,000ft the aircraft was found to be very unstable, and full-rated power was required to maintain a rate of climb of 250ft per minute. Between 21,000 and 26,000ft "the airplane was very hard to fly, very sluggish on the controls, and extremely unmaneuverable." The AAFPGC concluded its report by stating, "The XB-41 does not have sufficient power over the standard B-17 and B-24 to allow it to also carry a bomb load. It is further believed that if the standard B-17 and B-24 are equipped with adequate nose turrets, they will be capable of performing the function that the XB-41 was designed to perform and still carry an adequate bomb load."

On October 16 the Engineering Division reported that during the service testing of the YB-40 by the Eighth Air Force in the ETO the aircraft "appeared impractical and uneconomical" for use as a bomber escorter. It further noted that the YB-40 was not readily maneuverable, carried no bombs, and had no performance advantage over the bombers it was escorting. These facts equally applied to the XB-41. The development of a more versatile bomber able to increase or decrease firepower as that need arose was considered as more desirable. A "true escort was conceived as nothing more or less than a long-range fighter", noted the writer of the report. The only armament that was considered of value was the chin turret.

Three days after the delivery of this report, Brig Gen Grandison Gardner informed Brig Gen E. B. Ferrin, Deputy Chief of the Air Staff, that "everyone who participated in the [XB-41] tests agreed that it would never be satisfactory." Clearly, Materiel Command had made the correct decision to cancel the entire XB-41 project, which in turn stopped the aircraft from being sent to Britain for an operational evaluation. Gardner added that any future need for a Liberator bomber escort could be met by modifying a B-24H with the addition of turrets, which would give the aircraft "practically" the same firepower as the XB-41.

The AAFPGC issued its *Final Report: Comparative Performance of the XB-41 Airplane with the B-17F Airplane* on November 1, 1943. These Eglin Field tests, requested by Materiel Command, had the primary objective of determining whether the XB-41 was operationally suitable to be used as an escort for the B-17F bomber. As noted earlier in this

chapter, the test results categorically confirmed that the XB-41 was "not operationally suitable for use as a bomber escort airplane, and also the armament was not suitable as it did not have the firepower over the standard B-17 or B-24."

The report recommended that the aircraft's development be discontinued as "the plane is not maneuverable and has insufficient firepower to warrant the loss of a bomb load." It also stated that if it was to be further developed, the USMC M-5 waist gun mounts should be replaced by single hand-held waist guns on K-6 mounts, each with a N-8 gunsight. A "suitable" four 0.50-cal nose gun turret was suggested to be developed for "possible present and future use" in heavy bombers and in the XB-41 if its continued development was considered worthwhile.

Two weeks later the USAAF Board in Orlando, Florida, submitted a similar report titled *Tactical Suitability of XB-41 Airplane as Escort Bomber for B-17s*. It detailed test results from formations that had seen the XB-41 flying with as many as 18 B-17Fs on four- to six-hour flights at altitudes of 20,000 to 23,000ft. The USAAF Board concurred with all the AAFPGC's conclusions, stating:

1. The XB-41 was not suitable to be used to escort B-17 formations. It could not be flown safely in a large and close formation of B-17s due to its lack of power and sluggishness of controls, which was due to its additional weight and airfoil "disturbances" of the added equipment.
2. "Great difficulty" was experienced in any climb due to the "general characteristics of these type of aircraft." The B-17 climbed rapidly at slower speeds while the XB-41 climbed slowly at a higher speed.
3. The addition of a dorsal turret, two waist guns, and the extra ammunition over the standard armament of the new B-17G "does not appear to warrant this aircraft as a special ship without bombs."

The report also recommended that the XB-41 not be used as a bomber escort for B-17 formations, and that modifications of the B-24 or XB-41 for fighter destroyer or escort type aircraft "be dropped from consideration."

On December 8 the Eglin Field tests on the XB-41 were completed and the aircraft was transferred back to Wright Field, where it was determined that, "No further development or production of this type of airplane is presently contemplated. It has been recommended that the airplane be transferred to the Training Command." On January 5, 1944 the aircraft was duly assigned to Central Training Command at Randolph Field, Texas. The latter considered the XB-41 "in its present condition of no value" and requested permission from the Commanding General of USAAF Training Command, Lt Gen Barton Yount, to remove the armor plate protection and its seven turrets so that the stripped-out airplanes could be transferred to a B-24 Transition School where this "type of aircraft was very much needed."

On March 29 Materiel Command authorized Central Training Command to proceed with the "necessary action to rework" the XB-41 as it requested. 41-11822 was later re-designated as a TB-24D and used as an instructional airframe for training Liberator mechanics. On February 2, 1945 it was sent to the RFC at Maxwell Field, Alabama, for reclamation.

CHAPTER FOUR

OTHER BOMBER ESCORTERS

BOEING XB-38 ESCORTER

Shortly after the USAAF bomber escorter project commenced, it became apparent that the XB-41 would have inferior performance in respect to speed and rate of climb than the standard B-17s it was meant to be escorting into combat. In an attempt to rectify this, a change of engines was contemplated.

Installation of Allison V-1710 inline water-cooled V12 engines had already been considered for Vega-built B-17s prior to the development of the XB-40, the revised aircraft being designated the XB-38. Aside from the anticipated performance improvements associated with the inline engine, the V-1710 was seen as a suitable contingency powerplant configuration for the B-17 should the supply of Wright R-1820 Cyclone radials become limited as demand increased with the rapid expansion of the US armed forces. Since the XB-38 project was already underway, it was decided to continue with the aircraft's development separately from the XB-40 project, and possibly combine them at a later date.

After Vega had initially proposed the XB-38 during March 1942, the ninth B-17E (41-2401) was selected for testing with Allison engines. The USAAF approved the project (contract ac-28120) four months later, allowing the bomber's R-1820 radial engines to be replaced by V-1710s driving three-bladed, full-feathering propellers. Larger fuel tanks were also installed. It took more than a year to complete the modifications,

To increase the performance of the XB-40 and the standard B-17, their air-cooled Wright R-1820 radial engines were replaced by liquid-cooled Allison V-1710s in the XB-38. The XB-38's unusually shaped belly turret is actually a dummy mounting, this aircraft having originally been a B-17E with the smaller remote Briggs Sperry ventral turret. The approximate drag of the A-2 non-retractable turret fitted to the B-17F was needed when collating performance measurements, since any new B-38s would have been fitted with this version of the ball turret. Hence the installation of a dummy mounting. After a troubled test period during May–June 1943, the XB-38 program was abandoned with the total loss of the aircraft during its ninth flight on June 16, 1943. (Peter M. Bowers/Frederick A. Johnsen Collection)

which it was hoped would give the aircraft a greater maximum speed and longer range than a standard B-17F, but with a lower service ceiling.

XB-38 41-2401 was flown for the first time fitted with Allison engines on May 19, 1943, and it was almost immediately plagued by leaking exhaust manifold joints. These were quickly fixed, and the aircraft resumed flight-testing without a problem. However, on June 16, 1943, during the XB-38's ninth flight, a fire broke out in the No. 3 engine. The test crew was unable to extinguish the blaze and bailed out before it reached the main fuel tanks. The XB-38 was a total loss, and the project was cancelled as V-1710 engines were required for other higher priority test projects.

MARTIN XB-33 ESCORTER

The Glenn L. Martin Company began work on the Martin Model 190 as a high-altitude derivative of the company's B-26 Marauder in October 1940. The twin-tailed medium bomber, designated the XB-33, was to have been powered by two 2,200hp Wright R-3350 18-cylinder radial engines. With a tricycle landing gear, wing span of 100ft, and length of 71ft, the aircraft could carry 4,000lbs of bombs. Unlike the B-26, the XB-33 was to have pressurized crew compartments and a twin tail configuration similar to Martin's PBM Mariner flying boat.

After the USAAC had ordered two prototypes, and while the bomber was still in the design stage, it became evident that as more and more elements were added and the aircraft's weight increased, the XB-33 would not meet the desired performance requisites. Two unbuilt prototypes were duly cancelled and Martin instead developed the larger four-engined XB-33A with a 134ft wing span and a length of 79ft 10in. The aircraft was to be powered by four 1,800hp Wright R-2600-15 Cyclone engines instead of R-3350s, which were reserved for the B-29. On January 17, 1942 the USAAF ordered 400 B-33As, which were to be built at Martin's government-owned Omaha, Nebraska, factory. However, on November 25 that same year, the XB-33A project was cancelled to allow the Omaha plant to concentrate on manufacturing B-29s. The two incomplete XB-33A prototypes were dismantled, the project ending without any aircraft being built.

Materiel Command's Engineering Section considered the XB-33A as a "suitable type for conversion into a convoy protector airplane." The escorter variant would have had its armament increased by the addition of two or more 0.50-cal machine guns in the tail and a dorsal 0.50-cal four-gun turret fitted in place of the twin 0.50-cal turret fitted to the bomber variant. There was insufficient area in the wings or engine nacelles to mount a semi-flexible 37mm cannon. Indeed, it was considered "barely possible" that a single 20mm cannon or a 0.50-cal machine gun could be mounted in the outboard engine nacelles only. These additional weapons would have adversely affected the aircraft's maximum speed.

In addition to the armament changes, increasing ammunition loads, fitting more armor plating, enlarging the oil and fuel tankage, and improving the leak-proofing of the associated lines would not only equal but surpass the weight allowance gained by deleting the XB-33A's bomb load. In order to prevent the aircraft from exceeding the allowable gross

weight, some of the additional fuel load would have had to have been excluded. The increased leak-proofing of the tanks would have also reduced fuel capacity, leaving the XB-33A "convoy protector airplane" unable to attain the range required of it to serve successfully as a bomber escort.

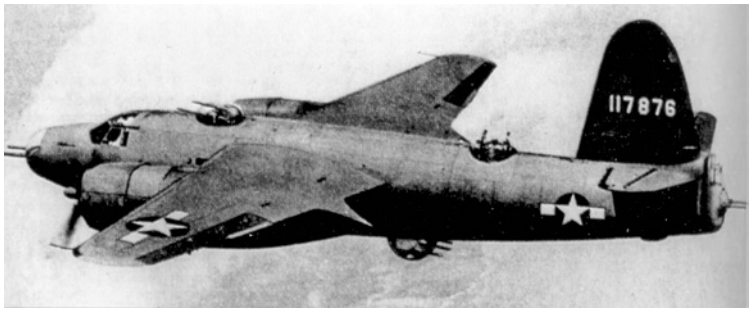
MARTIN B-26 ESCORTER

When Eighth Air Force B-26s suffered such heavy losses in low-level operations over the Continent after making their combat debut in the ETO in May 1943 that the USAAF contemplated phasing the aircraft out of production, potentially surplus Marauders were considered as escorts for VIII Bomber Command B-17 and B-24 formations. Indeed, two months later, Maj Gen Bernard Giles, Assistant Chief of Air Staff, ordered a high priority research project to determine the suitability of using "up-gunned" B-26s as escorts for high-altitude heavy bombers. The order stated:

"If feasible, this plan would solve two extremely urgent problems. First, it would solve the high casualty rate being suffered in bombardment operations in Europe and, second, a profitable use for the B-26 airplane, which will be available to the Air Forces in greater numbers than we can produce full bomber crews. B-26s, as escorts, would run interference for the bomber elements and would use both fixed and flexible guns as armament."

The B-26B-10 variant then entering frontline service differed from early models of the Marauder in a number of key areas. It was powered by uprated Pratt & Whitney R-2800-43 radial engines, had had its wingspan widened by six feet and boasted a taller fin and rudder. Armament was increased from six to twelve 0.50-cal machine guns, with four in the nose and two package/cheek guns added to either side of the forward fuselage so that the B-26 could continue to perform the low-level strafing role. The existing Martin dorsal turret was armed with twin 0.50-cal machine guns, while the tail turret was upgraded from manual to power-operated twin 0.50-cals. Armor was also added to protect the pilot and co-pilot.

The armament of the B-26 escorter was to be "five or six" forward-firing 0.50-cals plus two 20 mm cannon in the nose. In addition to the standard dorsal and tail turrets, power-operated turrets were to be installed above the navigator's compartment and in the belly of the aircraft – the former would be fitted with two 0.50-cals and the latter four. The flexibly mounted lower waist guns were to be deleted. The escorter was to be flown by a single pilot, and it would carry a further three crew to perform navigation, radio, and gunnery duties. With an intended gross weight of 35,281lbs, a gunship Marauder was forecast to have a top speed of 236mph at 22,000ft and a range of 1,550 miles at that altitude if a constant true airspeed of 233mph was observed. The modified empty weight was to be 23,387lbs, with a useful load of 11,894lbs.



An author-created rendition of the proposed B-26 escorter, which was to feature five or six forward-firing 0.50-cals plus two 20mm cannon in the nose. As well as the standard dorsal and tail turrets, the aircraft would have boasted two 0.50-cals in a powered turret above the navigator's compartment and four more such weapons in a ventral ball turret. The waist guns would have been deleted, however. (USAAF/Author's Collection)

The fourth YB-29 (41-36957) was modified into a 23-gun escorter during 1943 as per a USAAC directive dating back to August 1941 that stated each new bomber type should have a variant considered for such duties. (Gerald Balzer/Frederick A. Johnsen Collection)

Along with the 364lb bomb-bay fuel tank, 1,568lbs of internal fuel, and 100lbs of added armor for the pilot, the escort's additional armament added 2,539lbs to its loaded weight. To compensate for this increase, a number of items totaling 1,384lbs were scheduled for removal, including 785lbs of bombing equipment (bomb racks and bombsights), the automatic flight control equipment weighing 160lbs, and armor plating totaling 162lbs.

B-26B-10 Marauder 41-18185, formerly of the Twelfth Air Force's 442nd BS/320th BG in the Mediterranean Theater of Operations, was to be the first aircraft converted into a bomber escort but the plan to use heavily armed multi-engined aircraft to escort bombers was abandoned with the introduction of increasingly proficient escort fighters. Like the XB-40 and XB-41, the heavily laden B-26 bomber escort would have lagged behind the bombers they were meant to protect once the latter had dropped their ordnance and set course for home.

BOEING YB-29 ESCORTER

As previously noted, while waiting for an effective long-range fighter escort to be developed, the USAAC directed in August 1941 that each new bomber type should have a variant considered for escorter duties. Consequently, during 1943, the fourth YB-29 (41-36957) was modified into a 23-gun bomber escort. The standard YB-29 armament array consisted of forward and aft dorsal and ventral turrets, each with twin 0.50-cals (the dorsal forward turret was subsequently armed with four 0.50-cals), that were remotely controlled by gunners in three sighting blisters. The tail turret contained two 0.50-cals and a 20mm cannon.

The YB-29's experimental ERCO nose-mounted ball turret, fitted with twin 0.50-cals, and one of four side-mounted, remotely-controlled Emerson Model 126 barbettes are seen in this close-up photograph. Finally, one of two ventral turrets armed with two 0.50-cals and a 20mm cannon is also visible – the aircraft also featured two identically configured dorsal turrets. (USAAF)

The YB-29 escorter was provided with an experimental ERCO nose-mounted ball turret armed with two 0.50-cal guns and four low-profile, side-mounted, remotely-controlled Emerson Model 126 barbettes (two forward of the wing and two replacing the aft gunner blisters), each also with two 0.50-cals. The four dorsal/ventral turrets had their weaponry replaced by two 0.50-cals and a 20mm cannon, while the tail cannon was replaced with a 30mm weapon.

The YB-29 received only cursory testing before the concept was abandoned, and it later served as a training aircraft with the name *Cross Country.*

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Front Cover
On June 25, 1943, Maj James Griffith led 23 B-17s, including seven YB-40s, on a mission to attack the Blohm & Voss U-boat shipyard in Hamburg-Steinwerder. The Flying Fortresses encountered poor weather almost from take-off, causing problems with formation assembly (forcing two YB-40s to abort), target location (the shipyard was obscured by ten-tenths cloud), and the selection of a suitable secondary target. Blohm & Voss's smaller facility at Oldenburg, 40 miles east-northeast of Bremen, was targeted instead. Enemy fighter attacks on the bombers and their escorts were heavy, with B-17 gunners claiming four destroyed, one probably destroyed, and four damaged. Two of the German fighters claimed as destroyed and one of those damaged were credited to gunners in YB-40s. All the Flying Fortresses from the 92nd BG returned safely to base. (Cover artwork by Adam Tooby)